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THE EMPEROR WILLIAM CHURCH, BERLIN.

CHURCH ERECTED TO THE MEMORY OF EMPEROR WILLIAM.

The proposition to build a church to the memory of Emperor William met with general approval, and in a short time beautiful plans and a fine location in the western part of the capital of the empire were procured. The cornerstone of the new church was laid on March 22, 1891, and scarcely four years later the key of the edifice was handed to the empress, who was patroness of the association formed for the purpose of erecting the structure. The plans were drawn by Baurath Franz Schwechten, but were afterward modified considerably. The church was built in the form of a Latin cross, with two beautiful rose windows in the gables of the transept, which soften the Roman style of architecture and at the same time flood the interior with light. The choir is surrounded by chapels and small rooms that can be thrown together when desired. On the west is a beautiful memorial hall, with semicircular apses and portals in the front, the rich sculptural ornamentation of which reminds one of the finest works of the middle ages. The mosaics and sculpture on the high bronze doors represent the works of Emperor William. The grandeur of the nave and the choir, with its beautiful altar, is very impressive. The triumphal arch, with the statues of the apostles Peter and Paul and beautiful mosaic ornaments, was designed by Prof. Geselschap, and the statues of Luther and Melanchthon, which stand on the pillars, are by Otto Lessing. The bronzes, sculpture and other decorations make this one of the finest churches in Germany. It is very large and contains 1,800 seats, including those in the galleries. It cost more than $700,000. The principal tower is 370 ft. high. The building would never have been finished in so short a time if the work had not received the personal attention of their majesties and the untiring devotion of Frhrn. Von Mirbach.

For the accompanying engraving and the above data we are indebted to the Illustrirte Zeitung.

THE NEW YORK CLEARING HOUSE.

This building occupies a site upon the north side of Cedar Street, between Broadway and Nassau Street, in the center of that district of financial institutions which has grown up about Wall Street.

The Clearing House work is peculiar to itself, and has arisen out of the necessities of the banks of New York, which are associated to maintain it. These are now sixty-four in number, and their representative officers form the powerful financial institution which gives that unity and stability which distinguish the banking interests of New York.

The new edifice, designed by R. W. Gibson, the architect, of New York, is a handsome structure of white marble, in an Italian Renaissance style, somewhat reminiscent of public buildings of the colonial and independence periods. It is detached from adjacent structures, so as to show its own side walls and preserve its separate character. It has a frontage toward the street of about ninety-four feet, and a depth a little less. The front is of only three stories, but each is of palatial height, the first twenty feet, the second twenty-five feet, and the third twenty feet, with a domed roof of thirty feet more, making the total height about one hundred feet, with a cornice about seventy-five feet high. A Corinthian order is used, extending through the two lower stories, which not only gives a dignity of character but also serves to preserve masses of solid masonry in the four columns, in spite of the very large windows demanded for practical reasons, and to present the material in a way which will be effective in the foreshortened view in a narrow street. The first story windows, extending almost from column to column, have straight heads with a projecting balustraded cornice. Those of the second story have semicircular arches upon separate pilasters. Over these the main cornice is broken around each column so as not to obstruct daylight. An attic of liberal height surmounts the order. It is divided into three panels separated by statues on pedestals standing on each column. The panels are rich carvings of the national, State and city coats of arms, set in elaborate openwork scrolls and foliage, behind which are windows for the ventilation of the third story. The dome which surmounts this attic is principally an internal feature, providing great height and abundance of light to the large exchange room. It will not be much seen from the street, except at certain points, and the architectural composition of the exterior is complete without it.

The entrances are by porches at each end of the facade. Rusticated arched doorways nine feet wide and seventeen feet high, with handsome vestibules, afford dignified and ample approaches.

The Clearing House will use one, the eastern, and the other will be for its one tenant, a bank occupying the whole of the ground floor and a part of the basement. These banking offices will be of unusual extent and convenience. They include eight thousand feet of floor space, with windows on the side alley and rear courts, as well as the great windows fourteen feet wide at the front. The bank basement is equally well lighted. It will contain clerical space and vaults and dining rooms and other accommodations.

The Clearing House for its own use reserves a wide hall on the east side with a principal staircase for general business and with a private stair and elevator for staff and board uses. The main staircase is not supplanted by elevators in this building, as in many others. The peculiar circumstances of more than a hundred clerks arriving and departing almost simultaneously would, if elevators were to be used, have required ten or a dozen cars which would be idle at all other times. The stair is more available and is, therefore, treated with more of the old style importance. It is six feet wide, with easy steps and square landings, and massively built with Ionic columns and balustrades, so as to be a striking architectural feature. The white effects of the marble exterior will also be continued through the halls and staircase work in marble and enameled white and gold iron work.

The second story is the principal one. Here are the administration offices of the Clearing House, consisting of a reception office, a manager's office adjoining the assistant manager's and clerks' offices, all of which are toward the front of the building to the left of the stair hall. On the right are placed the board room, with one hundred chairs and with desks for presiding officer, secretaries, etc. There are ante-rooms with usual conveniences; one for coats, etc.; one for small committees. The hall of this board room department is reached from the main stair hall and also by a large private elevator from the private hall below. This elevator, which will be moved by electricity, will also serve for the transfer of bullion, coin and books to the vaults, and will be specially strengthened and secluded for that purpose. In addition, a private stair extends from this floor up to the roof and down to the basement. The board room is a square room treated massively with rich and heavy effects in decoration. The ceiling is in deep gilded paneling with large cornices supported by marble pilasters. Daylight is afforded by a top light with ornamental paneled glazing, and by windows placed at the two sides, so that neither the board nor its officers have to face an annoying glare. Communicating with the board room and the small committee room is the library, intended to be used also as a large committee room. It adjoins the manager's office and completes the circuit around the whole of this story. An object in this arrangement is to make these handsome rooms a suite available for official receptions and other ceremonies, which, although of only occasional occurrence, are yet of much importance. At such times the movement of the visitors is in one direction only. Entering at the reception room, they pass on through the other departments and reach the hall from the other side.

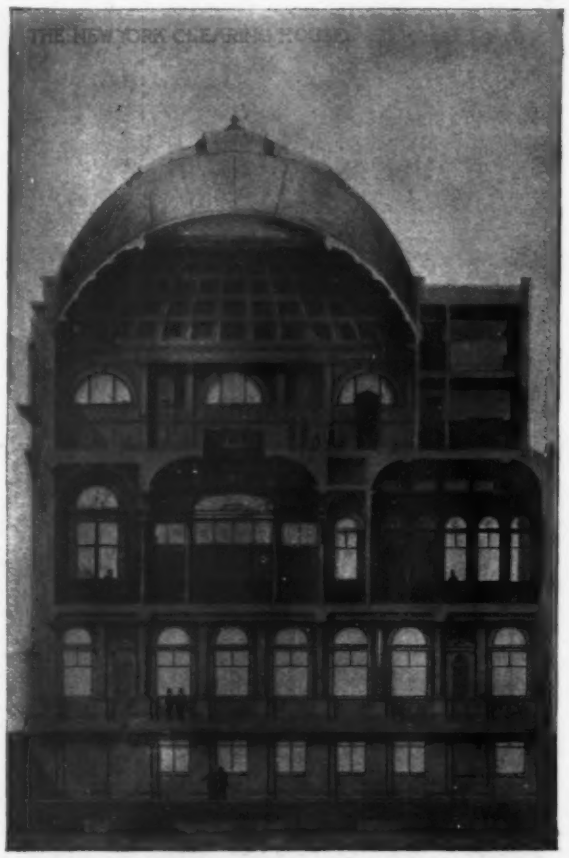
The remaining part of this floor is the cash department, occupying the central square of thirty feet immediately in face of the stairs and adjoining the assistant manager's office. This is the office where the daily balances are received from or paid to each bank after the amounts have been adjusted in the exchange or clearing room on the floor above. The cash department, and, in fact the whole of the second floor, is treated with considerable architectural effect. The great height permits of handsome ceilings. Intersecting vaults are used over the executive offices and an elliptical dome with glazed "eye" for daylight over the cash department. The library will have a coved ceiling of rectangular shape. The large board room ceiling will be of massive enriched panel work of Roman Renaissance type. The whole story will be treated altogether in the manner of the old public buildings upon which this is modeled.

The beautiful interior for this entire story, including all of the marble work, rich, and specially modeled decorative plaster work, cabinet wood trim, metal work, and all the furniture, is now being executed by D. S. Hess & Company, 876 Broadway, whose well known position and ability to produce superior and artistic workmanship assures excellent results.

The special sculpture work, consisting of six figures on the facade of the building, after much and careful consideration on the part of the architect and building committee, has been placed in the hands of Mr. J. Massey Rhind, the New York sculptor, who was so successful in his competitions for the celebrated bronze doors for the Astor memorial in Trinity Church, and the six large figures over the portico of the American Surety Company's new building (not yet placed in position). Mr. Rhind has practically told a story in his arrangement of figures, as thus: He holds that "Method" and "Trust" are the very foundations of the banking system, and taken jointly form, as it were, the keystone to the banking edifice. Therefore "Method" is represented on the left side of the center window and "Trust" on the right side. Method is an eight foot female figure, shown writing in a book, while underneath is a shield bearing the motto, "From chaos came order." Trust on the right side shows an eight foot female figure with sword in rest, and "shield" bearing motto, "Right fears no might."

The window to the left of center shows "Manufacture" and "Agriculture." These two branches embody the idea of "Trade," and the window to the right of center shows two figures representing "Railroad" and "Shipping," thus embodying the idea of "Commerce." So it will be seen that "Trade" on one side and "Commerce" on the other are bound together with the "Keystone," "Method" and "Trust." The carving will be done out of the same material of which the building is constituted, and the relief will be between alto and bass relief.

The third story is reached by a continuation of the principal stair. It consists chiefly of the great exchange, or clearing room sixty feet square, with two extensions or wings, making its greatest length eighty feet. This is a noble room, very simply treated, yet of great dignity. The ceiling is a dome rising twenty-five feet above the twenty foot walls. It is paneled in fireproof staff in Roman Renaissance style, and the walls have pilasters of a Corinthian order supporting the cornice and dome. The large floor will be occupied by the sixty-four desks of the settling clerks, each of whom has his own numbered station. The great space is needed to facilitate the visit of every clerk in turn to every other clerk, which is accomplished by an arrangement of the desks in serial order and a sort of "countermarch" during which the exchanges are effected. This is an interesting operation, which need not be more than referred to here. The manager's gallery, from which the business is directed, is at one end of the room, raised a few feet and reached by steps. It is also accessible by the private stairs and elevator for the convenience of the officers and visitors. The whole is lighted by a great iron and glass skylight forming the upper part of the dome.



THE NEW YORK CLEARING HOUSE.

Mr. Gibson, the architect of the New York Clearing House, and the building committee, which was composed of the presidents of the three leading banks of New York, unanimously agreed that the different contracts awarded in the building of the structure should be given only to those firms whose reputation in their special line of business was beyond question. In awarding the contract for the interior fitting of the building this was kept in mind, and when the contract was given to the Andrews Manufacturing Company, 76 Fifth Avenue, New York, for this part of the work, it became an assured fact that in the interior fittings the high standard of architectural beauty and the designs set forth on the exterior would be equaled, if not surpassed, and would harmonize with the rest of the building. Taking the interior of the building in its entirety, from basement to dome, the wood fittings and wood decorations are in elegant harmony.

The Chase National Bank, which occupies the first floor, is fitted in an unusually magnificent manner also by the Andrews Manufacturing Company. The counters, desks, lockers, etc., are designed in rich oak, with brass trimmings. The second floor, with its reception room, manager's office and clerks' offices, is also beautifully designed in oak.

The third floor consists of the great exchange or clearing room, sixty feet square. This is a noble hall, very simply treated, and yet of great dignity. The floor will be occupied by sixty desks and seats, which are made of oak of a special design. All the counters, lockers, desks, etc., and special wood trimmings were furnished by the Andrews Manufacturing Company.

At the rear of the Clearing House is a wing of the building divided into three upper stories. One floor reached by private stairs and elevator has a dining room for officers and clerks and a large pantry and

other conveniences. The next has the kitchen and appurtenances and janitor's dining rooms, and above that the janitor's private rooms. There are also two spare rooms, one arranged for staff use, with bath-room, etc., another as a spare office. In the attics there are spaces for storage and others occupied by ventilating fans.

The basement remains to be described. The engineer's department occupies a space under the sidewalk and the entrance hall. Here will be steam boilers for heating and engines for pumping. The motors for elevators and much of the other machinery will be electric. Four elevators for vault and cellar purposes will be used in addition to the passenger elevator. Two of these will be used to receive coin or bullion from the sidewalk and transfer it direct to the vaults. Beyond the engineer's department, and guarded by double walls and steel grilles, will be the large money vaults of the Clearing House, three in number. These will be of the most perfect modern construction, of

THE NEW YORK CLEARING HOUSE.

Cedar Street, between Broadway and Nassau Street.

welded steel and iron laminated compound plates, which combined with drill proof tempered steel with the toughest fibrous iron, to resist explosive forces, and with a system of inspection, devised by the architect, will be absolutely unassailable. The steel cells will be surrounded by an open space for patrol by the watchmen, who will have clear view, not only of the sides, but also the top and bottom of the vaults. There will be also concealed defenses against attack by force, and electricity and steam will be utilized in new ways as means of defense and to give alarm.

The construction of the whole building is most massive and perfectly fireproof. A steel skeleton is used to strengthen the framing, and the walls are all designed of the full thickness usual in buildings not of the skeleton class. The columns, girders and floor beams throughout are each separately calculated for their strains and loads, so that a rigid economy of construction is practiced, although the standard is fifty per cent. higher than that of the usual office building rules.

The sanitary engineering is thorough; every part of the building will be supplied with fresh air by ducts from fans and relieved of foul air by others, and this system will be for summer use as well as winter, supplying cool air independent of the heating.

The building project is in the care of a committee of prominent members: Mr. Frederick D. Tappen, president of the Gallatin National Bank; Mr. J. Edward Simmonds, president of the Fourth National Bank; and Mr. William A. Nash, president of the Corn Exchange Bank. The architect is Mr. R. W. Gibson, who has the expert assistance of Mr. J. M. Mossman in the vault and safe work, of Mr. Alfred R. Wolff in the ventilating work, and of Messrs. Pattison Brothers in electric work.

The great firm of Marc Eidlitz & Son, of 489 Fifth Avenue, were given the general contract for the erection of the building.

The general manager of the Clearing House, Mr. William Sherer, and the assistant manager, Mr. William J. Gilpin, in whose hands the administration of the new building will rest, are also active in the effort to make this edifice fit and perfect for its purpose. The task is unusual. There is but one Clearing House in New York, and it is utterly unlike the usual business house, even the usual Clearing House—so its headquarters will be unique. It will be the official focus of the American financial world as represented by the New York banks, and in that capacity will be a public building in all senses of the word, as well as a business office. To these objects the building is admirably adapted. It is convenient and practical, and externally is dignified and chaste, although richly elaborated. It is an ornament to the city upon which the banking world of New York may be congratulated.—Stafford's New Magazine.

A LARGE RAILWAY FERRY STEAMER.

MESSRS. Sir W. G. Armstrong, Mitchell & Company have just completed and dispatched a large railway ferry steamer for service in Russia, which is an extremely interesting vessel, constructed to meet conditions which are very unusual and difficult to comply with. The river Volga, across which the ferry is to ply, is very swift, and the difference between the extreme levels of midsummer and spring is no less than 45 ft. The embarking and disembarking the rolling stock, of course, becomes a question of considerable difficulty, and when to this is coupled the fact that unbroken communication has to be maintained between the two sides of the river, although ice of 2 ft. in thickness is in winter rather the rule than the exception, the problem assumes rather serious proportions. A powerful steam ice breaker was ordered for the purpose of making and keeping open the channel in which the ferry plies. This vessel, which was built by Messrs. Sir W. G. Armstrong, Mitchell & Company, was dispatched some time ago.

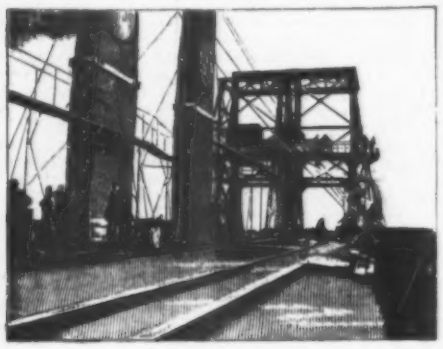
The locks of the Marinsky Canal system, through which all vessels bound for the Volga must pass, are of such dimensions as to make it necessary to divide both the ice breaker and the ferry steamer—the former into two and the latter into four parts. This has been arranged on Swan's patent system, which allows the division and subsequent reunion to be effected while the vessel is afloat. The principal dimensions of the ferry steamer are: Length, 253 ft.; breadth, 55 ft. 6 in.; depth, 14 ft. 6 in.

Four lines of rails are laid which converge at the

fore end into two, and sufficient space is provided on the rails for twenty-four trucks. The difficulty presented by the enormous difference in the river level has been overcome by an arrangement of hoists, actuated by hydraulic cylinders. This structure is placed at the bow of the vessel, and is so designed that two trucks can be lifted at once. The cradles, two in number, are flush with the deck when in the lowest position, the trucks are hauled onto them by means of an hydraulic capstan, and can be lifted to a height of 26 ft.

The landing stages on both sides of the river are of wood and have lines of rails at two stages, so that with the range of 25 ft. given by the hoist, the difficulty of the 45 ft. change of level is entirely overcome.

The pressure for the hoists is supplied by two horizontal compound direct-acting pumps, situated in the engine room, and connected by an arrangement of piping to the lifting cylinders. The pipes and connections, which are all designed for a working pressure of 750 lb., are coupled direct to the lifting cylinders without the interposition of accumulators, and are so arranged that either pump can be connected to either or both of the lifts. Special means have been employed to guard against the possibility of the water in the pipes and cylinders becoming frozen in the extremely low temperature experienced on the Volga in winter.



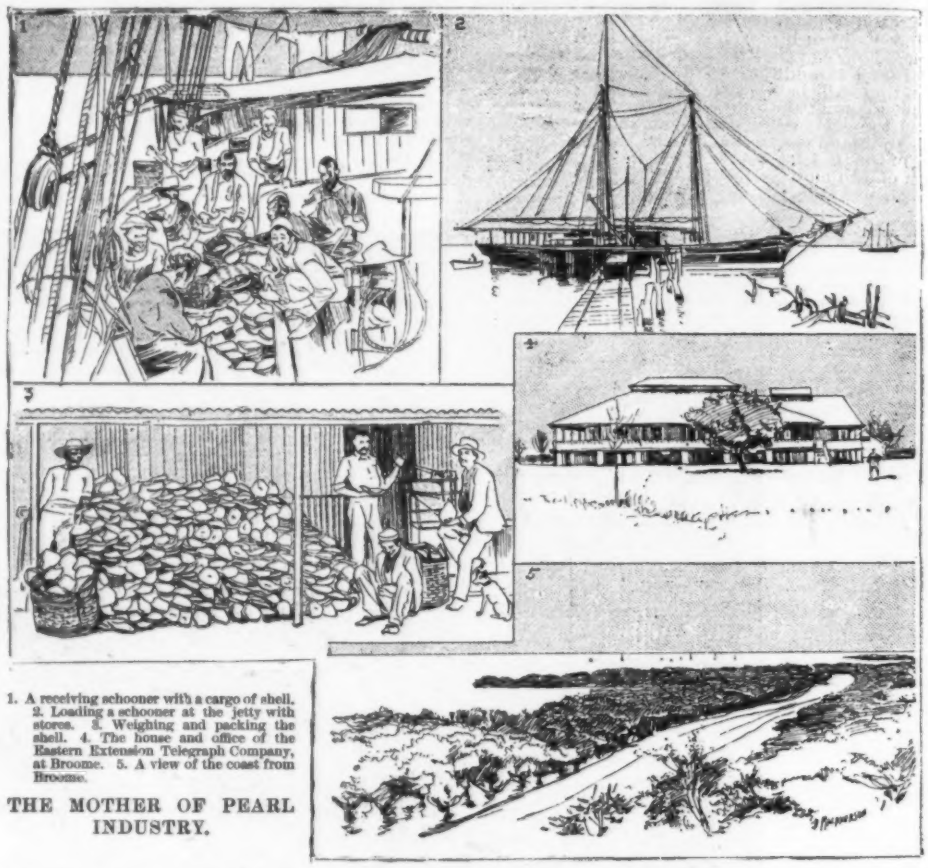
VOLGA FERRY STEAMER—VIEW FROM THE STERN.

The deck of the ferry steamer is, of course, flush, and as all the deck space is required for the accommodation of the railway trucks, the cabins for the captain, officers and engineers have been placed forward under the deck, all the rest of the space, with the exception of two holds, being taken up by the propelling and lifting machinery.

Advantage has been taken of the framing of the hydraulic hoists to make a large navigating bridge, with wheelhouse and all the usual appliances, and to afford support to the search light. A gangway above the level of the tops of the carriages, besides providing a convenient passage for the officers from one end of the ship to the other when all the rolling stock is on board, enables them to direct the operations of embarking and disembarking. The propelling machinery, which is of the inclined twin-screw compound surface-condensing type, has been skillfully arranged in the rather small space allotted for its accommodation. The clear height is very small, which rendered inclined engines and boilers of the straight through, or "navy type," a necessity. All the necessary arrangements are made for burning liquid fuel, and the burners present one or two features of great interest. The propellers are of bronze and are made of extraordinarily heavy scantlings, so as to enable them to resist the blows they will encounter in their service among loose ice, some of which will be of great thickness. The way through the ice will be cut, as already described, by the steam ice breaker, so that the ferry steamer will not, as a rule, be called upon to do any actual ice breaking. The strength of her hull is, however, proportioned to resist great shocks, and the bow is amply strong enough to break ice to a certain extent, although the form of the boat has been evolved to meet a set of circumstances of which ice breaking does not form the most important item.

The division of the ferry steamer into four parts has been carefully thought out, with the result that each quarter is a water-tight hull, bounded by the half length of the shell on one side and one end, and by longitudinal and transverse watertight bulkheads on the other, and is so arranged that the four portions can be separated and connected while the vessel is afloat. The trim of these quarters was a somewhat delicate matter to arrange, and one to which the distribution of the weights does not easily lend itself. It was found necessary to make pontoons, which will be attached to each quarter of the ferry steamer, and by this means the required trim and draught will be attained, when the division of the hull into four parts has been effected.

We are indebted to the Engineer, London, for our illustrations and the foregoing particulars.



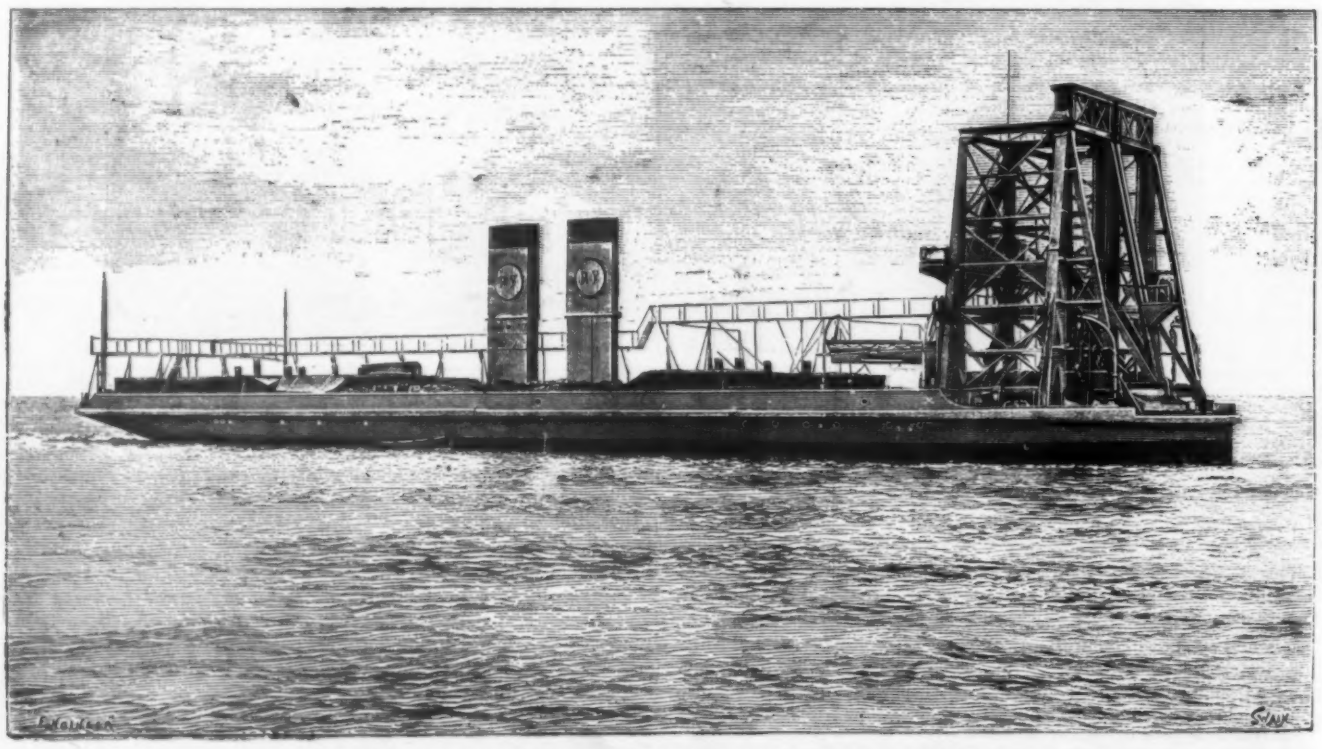
1. A receiving schooner with a cargo of shell. 2. Loading a schooner at the jetty with stores. 3. Weighing and packing the shell. 4. The house and office of the Eastern Extension Telegraph Company, at Broome. 5. A view of the coast from Broome.

THE MOTHER OF PEARL INDUSTRY.

THE MOTHER OF PEARL INDUSTRY.

ONE of the not least important industries in the golden colony of West Australia is the pearl shell fishery, which produces every year shell to the value of over $500,000, and pearls in proportion. The industry is carried on systematically, and large sums of money are spent on the pearling fleet and in keeping up the shore stations. It is estimated that over 1,000 men are employed in the trade. The shell is collected by divers working from luggers of about 15 tons, and with the use of Heinke's well known diving apparatus they are able to collect shell at a depth of 120 feet. These pearling grounds extend several hundred miles along the West Australian coast, but the center of the industry is at Broome, where the illustrations were taken.

Some interesting experiments have been made in the bays along the coast. A pearl shell nursery was formed under the direction of Mr. Savile Kent, the well known expert on all fishery questions. The cultivation and breeding of the mother of pearl oyster, which forms the chief article of the industry, is now being artificially tried, but at present it is too early to say what success the venture will result in. The illustrations include two sketches of fishing luggers. One is loaded with shell which was taken from the "grounds" on the previous day, and the other is being loaded alongside the jetty at Broome with all the tackle and appliances necessary for an expedition. Nearly all the produce of this industry comes to England. Before shipment the shell is taken to one of the shore stations, weighed, packed, and then put on board one of the vessels employed in bringing to this country the many and valuable products of West Australia.—Daily Graphic.

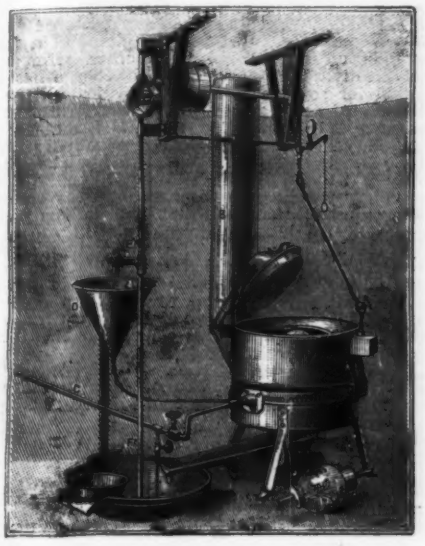


RAILWAY FERRY STEAMER FOR THE VOLGA.

SAND BLAST APPARATUS FOR ENGRAVING GLASS GLOBES.

THE principle of engraving glass by sand blast is well known and we shall not revert to it, but shall describe to our readers the arrangement of an apparatus that permits of engraving spherical glass globes.

In this apparatus, the globes to be engraved are placed in the receptacle, A, which is closed by a hinged cover. The sand is placed in the reservoir, D, and is drawn into the chamber, A, not by air, but by a jet of steam that enters through the tube, C. The sand, after producing its effect, runs through a tube into the receptacle, F, as does also a portion of the condensed steam. The excess of steam escapes through the conduit, B. The mixture of sand and water contained in the receptacle, F, is taken up by the pump, E, and emptied into the reservoir, D, in order to be utilized anew.—La Nature.



SAND BLAST APPARATUS FOR ENGRAVING GLASS GLOBES.

THE TUSSAH SILK INDUSTRY.

TUSSAH silk is a product that has come into fashion through a caprice of the feminine world. It is not generally known how it is produced and manufactured. It comes from India, where it has been employed for a long time. It is called by the following names: tussah, tusser, tusseh and tussore.

Tussah silk is produced by a silkworm called by the scientific name of Attacus mylitta, which inhabits all India except Rajpontana, Cachemire and Bouthan. It lives upon the following trees: Terminatia tomentosa, Lagerstroemia Indica, Ficus religiosa, Zizyphus jujuba, etc. In a wild state this worm is annual, but when reared, that is to say, reduced to semi-domesticity, it becomes bivoltin and trivoltin (gives two or three broods a year).

The tussah cocoon is large, well constructed and of close texture and is suspended by a fiber. It is reddish white and measures 50 millimeters in length by 30 in diameter. Its net weight, without chrysalis, is 120 milligrammes. The silk constituting the cocoon is about 1,200 meters in length, but of this only 500 or 600 meters can be reeled. Its fineness is eighty-four thousandths of a millimeter. It is very unequal throughout its entire extent.

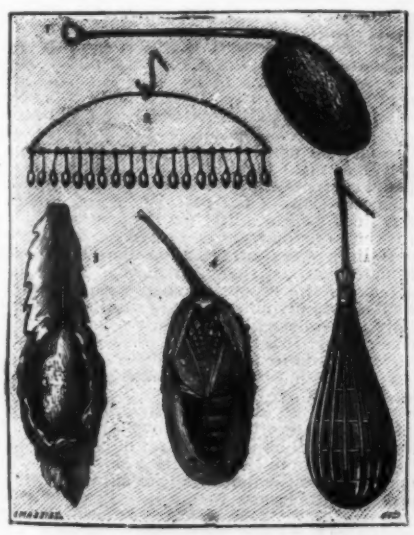


FIG. 1.—THE TUSSAH SILK INDUSTRY.

1. Tussah cocoon. 2. Cocoons suspended. 3. A recently woven cocoon. 4. Section of a cocoon, showing the moth just ready to emerge. 5. Bamboo cage.

With cocoons measuring 36 by 23 millimeters it requires 500 cocoons to make one kilogramme. In one kilogramme of cocoons there are 400 grammes of silk and 600 of chrysalids. It requires from 12 to 15 kilogrammes of recent cocoons to obtain one kilogramme of silk and from three to five kilogrammes of dry cocoons to obtain the same quantity.

Under the name of tusser is comprised in India a large number of varieties of cocoons that differ somewhat from each other in color, aspect, dimensions, and in the fineness of the silk. The principal are: the dabah cocoons, which are very large and of a dark gray, with silk of close and strong texture, that may be easily reeled; the monga cocoons, which are hard, light gray and smaller than the preceding, but richer in silk; the bogie or bogai cocoons, of medium size, pale gray, and producing much silk, that can be easily reeled; the laria or laringa cocoons, which are irregular, gray, poor in silk, and the product of unhealthy worms; and the jawie cocoons, which are light, poor in silk and not easily reeled.

In the rearing of the tussah the breeder suspends, by a string, from 20 to 25 cocoons from a bow formed of a curved branch (Fig. 1, Nos. 2 and 3). The chrysalids change into moths, which escape by piercing the cocoons (Fig. 1, No. 4) After coupling takes place, the males fly away and the females are put into an oval cage (Fig. 1, No. 5) called a moher, and which, at the end of the ninth day, is suspended from a tree that is to furnish food to the caterpillars. The caterpillars that are hatched from the eggs deposited by the females ascend to the top of the cage and gradually spread over the tree.

FIG. 2.—SHELTER AND COSTUME OF AN INDIAN BREEDER.

The rearing now begins. The Indian inhabits a shelter such as is shown in Fig. 2, and which is formed of a frame three meters in length by two in width covered with straw or herbs. This frame is portable, and when in use one of its sides rests upon the ground while another is supported by two stakes. The Indian is armed with a stick in order to protect himself against snakes and wild beasts. He wears the "cohotty," a band of fabric five meters in length by 60 centimeters in width. His legs and feet are naked. He wears a very large bamboo hat called a "chapy."

The trees upon which the rearing is done must be free from brushwood beneath. The caterpillars as they increase in size rapidly devour the leaves. After a tree has been stripped of the latter the breeder puts the caterpillars in his hat and carries them to another tree, and so on. He keeps birds away from the caterpillars with a weapon called a "gouillail," by means of which he projects balls of terra cotta. He protects his caterpillars from the aggression of flies by means of glue inclosed in a tube of bamboo. Into this tube he inserts a rod provided with a tampon at the extremity, and then, placing it upon the fly or other insect, removes and crushes it.

FIG. 3.—CHOULAH OR FURNACE FOR KILLING THE CHRYSALIDS.

After gathering his cocoons the breeder sells them to silk agents named "paikars," who dispose of them to the "pattouah" or Indian merchant. The chrysalids are killed by the latter, and not by the breeder. They have this work done by old men, out in the fields, and under rude sheds. The apparatus for the purpose (Fig. 3) consists of an earthen furnace measuring 30 by 25 by 45 centimeters. Upon this is placed a jar, B, full of water, called a "kolsy." Upon this is placed another jar, C, of the same form, called a "harry," and the bottom of which is provided with six one-centimeter apertures in which the cocoons are placed. Upon this is placed another jar, D, likewise filled with cocoons. Finally upon top is an inverted empty jar, E, forming a cover. The jars are luted to each other by means of clay. The fire having been lighted, the water is raised to ebullition in the jar, B, and its steam ascends into C and D and kills the chrysalids. The cocoons are exposed to the sun upon mats in order to dry them. The above described apparatus consist of two, three or four jars filled with cocoons. The apparatus consisting of four jars are the most frequent. Each jar contains from 250 to 300 cocoons, so that from 1,000 to 1,200 chrysalids are destroyed at a time.

The cocoons are boiled in an earthen vessel heated upon a primitive furnace. This is half filled with water to which is added crude soda or banana ashes, so as to form a lye containing from 11 to 12 grammes of soda to the liter. The vessel is filled two-thirds full of cocoons, which are boiled for an hour or more. Before they get cold they are stirred about with the bamboo cone shown in Fig. 4 in order to remove the floss. After this they are washed several times in a tub containing cold water.

FIG 4.—BOILING THE COCOONS.

The spinning is done by female operatives called "katani" seated upon stools and having one leg naked (Fig. 5). The operative puts the cocoons into a vessel, A, and unwinds from four to six at a time, in order to form a thread by twisting the fibers upon her knee. This thread she winds over a bamboo cone, C. She frequently dips the hand with which she forms the thread into a decoction of myrobolans contained in a pot within her reach. One woman can unwind 480 cocoons a day.

In order to render the tussah silk brilliant, it is purified by an operation that has received different names, and that consists in treating it in a boiling bath of ammoniacal soda. For 10 kilogrammes of silk, the bath consists of 200 liters of water and one kilogramme of the salt. After an ebullition of about an hour, the silk is rinsed in tepid water and immersed in a bath of hydrochloric acid (one liter of acid to 200 liters of water). Finally, another rinsing is effected in pure water.

In order to thoroughly bleach the silk, it is treated with oxygenated water. The bleaching bath is mounted with 20 liters of oxygenated water, 60 liters of warm water and one liter of silicate of soda to 10 kilogrammes of silk. The bath should have a temperature of from 50° to 60° C. The silk is left in the bath for from 12 to 15 hours, the bath during this interval being heated two or three times. After this the silk is rinsed in pure water, boiled for a few minutes in a bath of soap, and finally rinsed in a bath slightly acidified with hydrochloric acid. For some time past the bleaching has been done with peroxide of sodium. For 10 kilogrammes of silk the bath in this case is mounted with 250 liters of water, nine kilogrammes of sulphate of magnesia, and from two to three kilogrammes of peroxide of sodium. This latter product should be added in several portions in measure as the bleaching proceeds. After the last addition, the bath is heated to a temperature bordering upon that of ebullition. It takes two hours to effect the bleaching. The dyeing of the tussah silk is done by the usual processes.

FIG. 5.—SPINNING THE TUSSAH SILK.

For some years past, "craped," "bouilloned," etc., fabrics have been in fashion. In order to obtain such effects upon tussah silk, the latter is "mercerized" with chloride of zinc. Mercerizing consists in treating fabrics in baths of various substances that contract the fibers. The silk fabric is immersed for from half an hour to three hours in a bath of chloride of zinc at

a concentration varying from 20° to 40° Baumé. It is afterward dried and then suspended in a stove heated to from 25° to 30° until the desired effect of craping is obtained. The silk is afterward washed in a bath of carbonate of potash. According to the texture of the fabric, which may contain wool or cotton, the effects of crape as well as many other different effects may be obtained. By printing a gummy reserve, containing chalk, exhibiting varied designs, the parts that it covers are not mercerized and form designs consisting of thickened or contracted spaces, producing the most diverse effects. In place of chloride of zinc, a solution of oxide of nickel in ammonia is employed.—La Nature.

ON THE ELECTROLYSIS OF GASES.*

In the experiments described in this paper I have used the spectroscope to detect the decomposition of gases by the electric discharge and the movement of the ions in opposite directions along the discharge tube.

The method consists in sending the electric discharge through a tube so arranged that the spectra close to the positive and negative electrodes can easily be compared. The presence or absence of certain ions at these electrodes can thus be ascertained. This method is capable of much wider application than the one I previously used in my experiments on the "Electrolysis of Steam" (Proc. Roy. Soc., vol. lii, p. 90), the use of which is attended with very great difficulty for any substance other than steam. The earlier method has, however, the advantage of being a quantitative method—the present one is only qualitative.

In my former experiment with steam, when I worked at atmospheric pressure and varied the length of the spark, I found that when the spark length exceeded a certain length, d_1, there was an excess of hydrogen at the negative electrode and of oxygen at the positive, equal in amount to the quantities of hydrogen and oxygen liberated from a water voltameter placed in series with the steam tube. When the sparks were shorter than a certain length, d_2, the hydrogen appeared at the positive, the oxygen at the negative electrode, but the quantity of these gases was again equal to the quantities liberated in a water voltameter placed in series with the steam tube.

When the spark length was between d_1 and d_2, the effects were irregular, and there seemed to be no connection between the amounts of gases liberated in the steam tubes and those liberated in the voltameter.

In the following experiments in which the sparks were of constant length and the pressure was altered, corresponding effects were observed. Within certain limits of pressure definite and perfectly regular evidence of the separation of the ions of the gas sparked through was obtained; and the electrode at which a given ion appeared could be reversed by altering the pressure; there was, however, a range of pressures in which the separation of the ions was either not well marked or was irregular in character.

I shall begin by describing a very simple method of showing the separation of the ions produced by the discharge of electricity through a compound gas such as hydrochloric acid gas, which is applicable when the discharges through the constituent gases of the compound are of distinct and different colors; this is eminently the case with the hydrochloric acid gas, as the discharge through hydrogen in a capillary tube is red, through chlorine, green.

Take a capillary tube of very fine bore, the finer the better (the tube I used was thermometer tubing of the finest bore I could procure), and insert platinum wires for electrodes in two small bulbs blown on the ends of the tube; then fill the tube with HCl gas, allowing it to run through the tube for a considerable time, so as to get rid of any extraneous gas, and exhaust the tube so that the gas in it is at a very low pressure.

Then when the discharge from a large induction coil passes through the tube, the following phenomena are observed. When first the discharge passes through the tube, the color is uniform throughout and of a greenish gray; after the discharge has been passing for a little time the end of the tube next the cathode gets distinctly red, while that next the anode gets green; this difference in the color at the ends of the tube goes on increasing until the tube presents a most striking appearance, the part near the cathode being bright red, while that near the anode is a bright green. The difference in color attains a maximum value, and if the discharge is allowed to run for several hours the contrast between the two ends disappears to a very great extent; the discharge throughout the whole of the tube being pinkish and apparently passing mainly through hydrogen. This is doubtless due to the diffusion through the tube of the hydrogen which in the earlier stages of the discharge had accumulated about the cathode; one advantage of using very narrow tubes is that with them this diffusion is slow. When the tube is in this condition the color of the discharge sometimes changes suddenly, and for a second or two is green instead of pink, showing that though in the main the discharge passes through hydrogen, it occasionally leaves the hydrogen and passes through the chlorine. This transference of the discharge from one constituent to another of a mixture of gases is not infrequently observed when the gases are mixed in certain proportions.

Some of these capillary tubes showed after the discharge had been passing through them for some time a peculiar patchy appearance, some portions of the tube being a much brighter red than the others, while other portions were green. In some tubes this occurred to such an extent that the discharge showed an irregularly striated appearance. This effect is due, I believe, to gases or moisture condensed on the walls of the capillary tube, and in some cases to irregularities in the chemical composition of the glass. I found that it did not occur if the tube before being used was heated for some time along its whole length to as high a temperature as it would stand without collapsing; this heating would tend to cleanse the walls of the tube. That differences in the quality of the gas also conspire to produce these patches is shown, I think, by the following phenomenon. A capillary tube of fine bore containing mercury vapor and a little water vapor developed a well marked red patch; the tube was then heated for some inches in the neighborhood of the patch. In general heating the tube makes the discharge yellow from the sodium vapor given off from the glass; in this case, however, the whole of the heated portion, with the exception of the patch, turned yellow; the patch itself withstood the heating and continued to show the bright color characteristic of hydrogen.

Electrolytic Transport of one Gas Through Another.—A tube of the shape shown in Fig. 1 was made of the

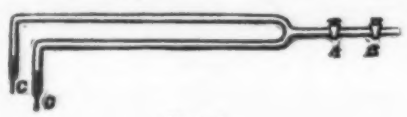


Fig. 1.

finest bore thermometer tubing; the extremities, C and D, of the tube in which the electrodes were fused were bent down so as to be parallel to each other, and so near together that a slight motion of the tube suffices to bring either of the extremities in front of the slit of the spectroscope. The tube was mounted on a board moved by a lever; by moving this the observer at the spectroscope could readily bring the spectrum of either the positive or negative electrode into the field of view.

A side tube, A B, was fused to the middle of the main tube and was provided with two taps; in the space between these taps a small quantity of any gas which it was desired to introduce into the main tube could be imprisoned, and could, by opening the tap, A, be introduced into the discharge tube. The experiment consists in filling the main tube with a gas at a low pressure, observing the spectra at the two electrodes, then introducing by the side tube a very small quantity of gas into the main tube, and again observing the spectra at the two electrodes.

A tube was filled with hydrogen and showed no trace of the chlorine spectra; a very small quantity of chlorine was then let in through the side tube (in performing this experiment it is necessary to be careful that only a very small quantity of chlorine is introduced). After the discharge had been running through the tube for a short time, the chlorine spectrum was found to be bright at the positive electrode, though no trace of it could be detected at the negative.

When the discharge was kept on for some time, the chlorine spectrum, though still visible at the positive electrode, got fainter; it did not appear at all at the negative. If a considerable quantity of chlorine was introduced through the side tube, the chlorine spectrum was visible at both electrodes, though it was brighter at the positive than at the negative.

When the induction coil was reversed, so that what was before the positive electrode became the negative, the first effect observed was that the chlorine spectrum flashed out with great brilliancy at the old positive electrode, and was much brighter than at any previous period. This, however, only lasted for a second or two; the chlorine spectrum rapidly faded away and for a time was not visible at either electrode. Soon, however, the chlorine spectrum appeared at the new positive electrode, having thus been transferred from one end of the tube to the other.

On again reversing the coil the same phenomenon was repeated. There is apparently no limit to the number of times this effect may be obtained; at any rate, I have driven the chlorine from one end of a tube to the other fourteen times in succession by reversing the coil. The chlorine is always driven to the positive electrode, showing that the chlorine ion carries a charge of negative electricity. The same effect was obtained when a little vapor of bromine was introduced into the tube instead of chlorine. When, however, the capillary tube was filled with chlorine instead of hydrogen, and a little vapor of bromine let into the tube, the bromine went to the negative electrode instead of to the positive, as it did when introduced into the hydrogen tube.

These experiments suggest that the two gases in the tube combine, and that the compound gas so formed is split up into ions which travel along the tube; that bromine when in combination with hydrogen is the negative ion, and therefore travels to the positive electrode; when, however, it is in combination with chlorine, the bromine is the positive ion and travels to the negative electrode.

Another experiment tried was to let a little vapor of sodium into the middle of a capillary tube filled with air at a low pressure. To prevent the sodium vapor condensing on the walls of the tube, the whole tube was placed on a sand bath and the temperature raised so high that no condensation took place. After the discharge had run through the tube for about two hours the sand was removed from the tube, and the movement of the sodium vapor to the negative electrode was very apparent even without using a spectroscope, as there was a great patch of yellow light near the negative electrode and none in any other part of the tube.

Another experiment was to introduce a small quantity of hydrogen into a tube filled with air at a low pressure; the hydrogen made its way to the negative electrode. This experiment is a somewhat troublesome one, as it is exceedingly difficult to get these very fine capillary tubes so dry that the spectrum of the discharge does not show the hydrogen lines even before the hydrogen is introduced into the middle of the tube; indeed, I never succeeded in getting rid of the hydrogen lines at the very lowest pressures. By heating the tube and allowing dry air to run through it for a long time, however, I got the tube so dry that it did not show the hydrogen lines at a pressure quite low enough to allow the discharge to pass freely through it.

When the tube was in this state and hydrogen was let into the middle of the tube, the hydrogen spectrum appeared at the negative electrode, but not at the positive.

The appearance of hydrogen at the negative electrode when mixed in the discharge tube with other gases has been described by Mr. Baly in a very interesting paper in the Philosophical Magazine, vol. xxxv, p. 200.

The preceding experiments suggest, I think, that this separation of the gases, A and B, by the discharge is due to the decomposition by the discharge of a chemical compound formed of A and B, in which the A atoms have a charge of electricity of one sign, the B atoms a charge of electricity of the opposite sign; these charged atoms under the influence of the electromotive force in the tube travel in opposite directions. Further, it follows from the experiment with the bromine vapor in an atmosphere of chlorine that the sign of the electrical charge on an atom of the same substance is not invariable, but depends on the substance with which this atom is in combination. We shall find numerous other instances of this change in the sign of the charge on an atom in experiments described in a later part of this paper.

Polarization of the Electrodes.—This in the electrolysis of liquids is due to the accumulation at the electrodes of ions which have ceased to act as carriers of electricity. We have, I think, distinct evidence of a similar accumulation in the electrolysis of gases. For, as has been already described, after the discharge has been running for some time in one direction, giving the spectrum of some gas at one of the terminals, the spectrum of the gas at that terminal is momentarily brightened to a very great extent by suddenly reversing the direction of the discharge. After the current has been flowing for some time in one direction through, say, Cl in an atmosphere of H, the spectrum of the chlorine, though still visible at the positive electrode, gets faint, the chlorine apparently to a great extent ceasing to carry the discharge; when, however, the current is reversed, the atoms of chlorine can move freely, as they are not obstructed by the electrode, so that immediately after the reversal of the current there is probably more of the discharge carried by the chlorine than at any other time, and the chlorine spectrum is consequently brightest.

Discharge Through a Compound Gas.—The separation of the ions by the discharge can be readily observed in a tube of the kind shown in Fig. 2.

Fig. 2.

It differs from an ordinary discharge tube merely in having a flat metal plate, A B, fastened across the tube. When the discharge passes through the tube, one side of the plate acts as a positive, the other as a negative electrode. The tube is mounted on a stand, which the observer at the spectroscope can move by means of a lever so as to bring one side or other of the plate opposite the slit of the spectroscope; a very slight movement of the lever is sufficient to do this, so that the spectra at the two sides of the plate can readily be compared. I found that the results were more satisfactory when the current was kept flowing through the tube in one direction and the tube moved so as to bring the spectra at the two electrodes into the field of view than when the tube was kept fixed in one position and the current reversed. The latter method, however, suffices to show the separation of the ions in many cases, and it has the advantage of not requiring a plate across the tube; all that is necessary is to use for one of the terminals a disk whose plane is parallel to the slit of the spectroscope.

If the plate, A B, is thin, it is necessary to fuse it into the glass tube all the way round; otherwise, when the pressure is low, the discharge, instead of crossing the plate, goes through any little crevices there may be between the plate and the tube. The easiest way of making the tube is to use a plate about 0·5 cm. thick, cut from an aluminum cylinder which tightly fits the tube; with a plate of this thickness the narrow spaces between the tube and the plate are so long that the discharge goes through the plate rather than through the crevices.

The tube was filled with the gas to be observed and the spectra at the two sides of the plate compared. These spectra were in many cases found to differ in a very remarkable way; it was, however, only in exceptional cases that a line which was bright at one side of the plate was absolutely invisible on the other.

The method used was to take two sets of lines, say, A and B, as close together in the spectrum as possible, and compare the brightness of these sets of lines on the two sides of the plate; if it was found that the A lines were brighter on the positive side of the plate than on the negative, while on the other hand the B lines were brighter on the negative side of the plate than on the positive, then it was inferred that electrolytic separation had occurred, and that the substance giving the A lines was in excess on the positive side of the plate, that giving the B lines on the negative. It is not safe to draw any conclusions from the variations in intensity of one line or one group of lines on the two sides of the plate, as the total quantity of light coming from the neighborhood of the cathode often differs considerably from that coming from the anode. When, however, we get an increase in the brilliancy of one set of lines accompanied by a diminution in the brightness of another set, when we move across the plate we eliminate this source of error. The differences in the spectra at the two sides of the plate are most easily observed at pressures where there is not any very great difference between the luminosity of the cathode and the anode. As was mentioned at the beginning of the paper, there is a range of pressure within which the effects are irregular, and no decided differences are observed between the spectra at the two sides of the plate. It is desirable in these experiments to keep the tube on to the pipe as long as the experiment lasts, for the discharge always decomposes the compound gas, and unless the products of decomposition are continually pumped off and replaced by fresh supplies of the compound gas, the spectra of the discharge keep changing. With organic compounds this is especially necessary, as the character of the spectrum often changes entirely very shortly after the commencement of the discharge unless fresh gas is continually introduced.

(To be continued.)

* Paper read at the Royal Society, by J. J. Thomson, M.A., F.R.S., Cavendish Professor of Experimental Physics, Cambridge.—Nature.

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In the following list the titles are grouped by topics, arranged alphabetically. The sign plus (+), following a date, signifies current.

Agricultural Chemistry.

BOUSSINGAULT, J. B. Agronomie, chimie agricole et physiologie. Paris. Troisième édition. 1880. 2 vols., 8vo.

A standard treatise by a pioneer in scientific agriculture.

JOHNSTON, J. F. W. Elements of Agricultural Chemistry and Geology. Thirteenth edition. London. 1883.

A remarkably successful work, honored by translation into nearly all the languages of Europe.

SACHSSE, ROBERT. Lehrbuch der Agrikulturchemie. Leipzig. 1888.

STORER, FRANK H. Agriculture in some of its Relations with Chemistry. New York. 1887. 2 vols.

An important contribution to the science.

WILEY, HARVEY W. Principles and Practice of Agricultural Analysis. Easton. 1895. 2 vols.

Embodies the most recent and the official methods of American analytical chemists.

Agricultural Chemistry. Serials.

Proceedings of the Annual Conventions of the Association of Official Agricultural Chemists. Washington. 1884-'95.+

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ALLEN, ALFRED H. Commercial Organic Analysis. London. 1889-'92. 3 vols.

A very full and comprehensive treatise.

BLAIR, A. A. The Chemical Analysis of Iron. Philadelphia. Second edition. 1891.

The author has had a large experience in the matter of which he writes.

BOLLEY'S Handbuch der technisch-chemischen Untersuchungen. Leipzig. 1888-'89.

Classical, but not especially adapted to American work.

CROOKES, WILLIAM. Select Methods in Chemical Analysis. Third edition. London. 1888.

A convenient compilation, especially valuable for indications of the rarer elements.

FRESENIUS, C. R. System (A) of Instruction in Qualitative [and Quantitative] Analysis. 2 vols., 8vo. London and New York. 1881.

Indispensable. German editions follow each other rapidly. The latest is to be preferred.

PRESCOTT, ALBERT B. Organic Analysis. New York. 1887.

Original, excellent.

SUTTON, FRANCIS. Systematic (A) Handbook of Volumetric Analysis. Sixth edition. London. 1890.

Drawn largely from Mohr's "Titrir-methode," and therefore good.

WILL, HEINRICH. Tables for Qualitative Chemical Analysis. Philadelphia. Second edition. 1874.

Convenient for beginners, though called old fashioned. German editions are more recent.

Analytical Chemistry. Serials.

Journal of Analytical Chemistry. Easton. 1887-'93

In 1894 united with the Journal of the American Chemical Society.

Zeitschrift für analytische Chemie. FRESENIUS. Wiesbaden. 1862-'95.+

The most important serial on the subject.

Revue de chimie analytique appliquée à l'industrie. Paris. 1893-'95.+

Assaying.

MITCHELL, JOHN. Practical Assaying with copious Tables, edited by William Crookes. London. New edition. 1888.

RICKETTS, P. DE P. Notes on Assaying and Assay Schemes. New York. Fourteenth edition. 1891.

Tested by experience of many years and not found wanting.

Biography.

DALTON, JOHN and the Rise of Modern Chemistry. By Sir H. E. Roscoe. London and New York. 1895.

Agreeably written by a master in the art.

FIGUIER, LOUIS. Vie des savants illustres. Paris, n. d. 5 vols. Portraits and illustrations.

Popular, and more entertaining than accurate; no other work covers the ground.

HOFMANN, A. W. VON. Zur Erinnerung an vorangegangene Freunde. Braunschweig. 1889. 3 vols., 8vo.

Contains biographies of many modern chemists contemporaries of the eminent German author.

LAVOISIER, A. L. Lavoisier 1743-1794 d'après sa correspondance. . . . Par Ed. Grimaux. Paris. 1888.

The best biography of the unfortunate Lavoisier.

LIEBIG, J. VON. An Autobiographical Sketch. In Chemical News. Vol. 63, p. 265 (June, 1891). Also in Popular Science Monthly. XL, 635 (1892).

A charming inside view of the early educational experiences of Liebig.

SCHEELE, C. W. Nachgelassene Briefe und Aufzeichnungen. Herausgegeben von A. E. Nordenskjold. Stockholm. 1892.

The best biography of the eminent Swede.

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Blowpipe Analysis.

ELDERHORST, WILLIAM. Manual of Blowpipe Analysis. By H. B. Nason. Philadelphia. 1891.

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Plattner's Manual of Qualitative and Quantitative Analysis with the Blowpipe. Translated by H. B. Cornwall. Third edition. New York. 1875.

An important work for advanced students and for reference.

Dictionaries.

ENCYCLOPEDIE CHIMIQUE. Rédigé par E. Fremy. Paris. 10 vols. In progress. About 95 parts.

The most voluminous of chemical dictionaries.

HANDWOERTERBUCH (NEUES) DER CHEMIE. Redigirt von von Fehling und Carl Heil. Braunschweig. 1871-'95.

A valuable work of reference. In progress.

LADENBURG, A. Handwörterbuch der Chemie. Breslau. 1882-'95. 13 vols.

A rival to the preceding. Rich in references to literature.

STORER, F. H. Dictionary of Solubilities. Cambridge. 1864.

Scarce; a new work by Arthur M. Comey is in type.

THORPE, T. E. Dictionary (A) of Applied Chemistry. London. 1890-'95. 3 vols., roy. 8vo.

Very valuable; modern and comprehensive.

WATTS' Dictionary of Chemistry. New edition by Forster Morley and M. M. Pattison Muir. London. 1894. 4 vols.

Standard; the first edition is still very useful.

WURTZ, ADOLPHE. Dictionnaire de chimie pure et appliquée. Paris. 1867-'70. 5 vols.

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NIETZKI, R. Chemistry of the Organic Dyestuffs. Translated from the German. London. 1892.

SCHULTZ, GUSTAV. Chemie (Die) des Steinkohlentheers, mit besonderer Berücksichtigung der künstlichen organischen Farbstoffe. Braunschweig. Zweite Auflage. 1886-'90. 2 vols.

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CROOKES, WILLIAM. Practical (A) Handbook of Dyeing and Calico Printing. New edition. London. 1883.

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BATTERSHALL, J. P. Food Adulteration and its Detection. New York. 1887.

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BELL, JAMES. Chemistry (The) of Food. 2 parts. London. 1881.

BLYTH, ALEXANDER WYNTER. Foods, their Composition and Analysis. Third edition. London. 1888.

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KOENIG, J. Chemie der menschlichen Nahrungs- und Genussmittel. Berlin. 1882-'89. 2 vols.

Full and accurate, and thoroughly scientific.

See the Bulletins of the U. S. Department of Agriculture. Division of Chemistry. Washington.

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Vierteljahresschrift über die Fortschritte auf dem Gebiete der Chemie der Nahrungs- und Genussmittel. Berlin. 1887-'95.+

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BUNSEN, ROBERT. Gasometry. Translated by H. E. Roscoe. London. 1857.

Although bearing so early a date, an important work for instruction.

HEMPEL, WALTHER. Methods of Gas Analysis. Translated by L. M. Dennis. New York. 1892.

WINKLER, CLEMENS. Handbook of Technical Gas Analysis. Translated from the German. London. 1885.

A practical treatise.

General Chemistry.

GMELIN, LEOPOLD. Handbook of Chemistry. Translated by Henry Watts. London. 19 vols. 1848-'72.

A classical work of immense value, though now out of date.

GRAHAM-OTTO'S Ausführliches Lehrbuch der Chemie. 5 vols. in 9 parts. Braunschweig. 1863-'78.

Exhaustive, unfortunately discontinued in an incomplete state.

JOHNSTON, J. F. W. Chemistry (The) of Common Life. New York. 1860.

For general readers, not specifically educated in chemistry, most useful and interesting.

MENDELEEFF, DMITRI. The Principles of Chemistry. Translated from the Russian. London. 1892.

The discoverer of the Periodic Law embodies in this work his advanced views.

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Text books of value by an eminent teacher.

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Chemical Gazette. London. 1842-'59, and the Chemical News. London. 1860-'95.+

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Jahresbericht über die Fortschritte der Chemie. Braunschweig. 1847-'92.+

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This important German organ will soon commemorate its centenary.

Journal of the American Chemical Society. New York. 1876-'95.+

The official organ of American chemists.

Journal of the Chemical Society [of London]. London. 1841-'95.+

As its name indicates, the official organ of British chemists.

Liebig's Annalen der Chemie. Leipzig. 1832-1895.+

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History.

BERTHELOT, MARCELLIN. Les Origines de l'alchimie. Paris. 1885.

[The same] La Révolution chimique. Lavoisier. Paris. 1890.

Valuable, readable, original.

BUCKLEY, ARABELLA B. A short History of Natural Science. New York. 1891. 12mo.

Intended for young readers, but a good review of the progress of science in all ages, including physics and chemistry.

FIGUIER, LOUIS G. L'Alchimie et les alchimistes. Paris. 1860. 12mo.

Entertaining and popular; drawn chiefly from German sources.

HOEFER, FERDINAND. Histoire de la Chimie. Paris. 1866-'69. 2 vols., 8vo.

Long a standard French history, but now rendered in part obsolete by Berthelot's studies on the earliest alchemical MSS.

KOPP, HERMANN. Geschichte der Chemie. Braunschweig. 1843-'47. 4 vols.

Classical, rare; a new edition is needed.

LIEBIG, JUSTUS VON. Familiar Letters on Chemistry. London. 1851.

Although bearing so early a date, well worth perusal. The edition of 1851 is the best in English. Has been published in ten languages.

MEYER, ERNST VON. History of Chemistry from earliest times to the present day. Translated from the German. London and New York. 1891. Second edition. 1894.

Standard; the best all around history of chemistry.

NAPIER, JAMES. Manufacturing Arts in Ancient Times, with special reference to Bible History. Paisley. 1870. 8vo.

Interesting to students of the origin of things, and to readers of the Holy Bible.

RODWELL, GEORGE F. The Birth of Chemistry. London. 1874. Illustrated.

A popular little essay on the earliest period of chemistry.

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The best essay on the development of chemistry in America.

VENABLE, FRANK P. Short (A) History of Chemistry. Boston. 1894.

A good, brief review suited to the class room.

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JACKSON, CHARLES L. Laboratory Experiments in Chemistry. Cambridge. 1885.

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Clearly written by an able hand.

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LUDWIG, ERNST. Medicinische Chemie. Wien. 1885.

WITTHAUS, R. A. Medical (The) Students' Manual of Chemistry. New York. 1890.

Most admirable; adapted to general students as well as medical students.

Medical Chemistry. Serial.

Journal de chimie médicale de pharmacie, de toxicologie [etc.] Paris. 1825-'74.
Continued as:
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AUSTEN, WILLIAM C. ROBERTS. Introduction to the Study of Metallurgy. Third edition. London. 1894.

PERCY, JOHN. Metallurgie (Die) Uebertragen von Knapp, Wedding und Rammelsberg. Braunschweig. 1862-'88. 4 vols. and 2 Supplement vols.

A comprehensive work. The German edition is fuller and more recent than the original.

Metallurgy. Serial.

Revue universelle des mines, de la métallurgie, [etc.] Paris. 1857-'95.+

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BEILSTEIN, F. Handbuch der organischen Chemie. Dritte Auflage. In progress.

A monument of industry; the most exhaustive work on the subject in print.

REMSEN, IRA. Introduction to the Study of the Compounds of Carbon. Boston. 1895.

The best textbook for instruction in organic chemistry ever published.

RICHTER, VICTOR VON. Chemistry of the Carbon Compounds. Translated from the German. Philadelphia. 1891.

Compare under GENERAL CHEMISTRY, same author.

See also under GENERAL CHEMISTRY, the volumes on Organic Chemistry.

Organic Chemistry. Serial.

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A recent claimant for honors.

Pharmaceutical Chemistry.

ATTFIELD, JOHN. Chemistry, general, medical and pharmaceutical. Fourteenth edition. London. 1883.

The number of the editions attests its wide popularity.

FLUECKIGER, FRIEDRICH AUGUST. Pharmaceutische Chemie. Berlin. 1897. 2 vols.

A standard work by a learned writer and teacher.

Pharmaceutical Chemistry. Serials.

Druggist's Circular and Chemical Gazette. New York. 1857-'95.+

The oldest American journal of pharmacy, still current.

Jahresbericht der Pharmacie. 1841-'95.+

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Physical Chemistry.

CLARKE, F. W. Constants (The) of Nature. Specific Gravities, Boiling Points, etc.; Specific Heats, etc.; Smithsonian Miscellaneous Collections. Washington. 1873-'88.

Valuable tables for reference.

ROSCOE, H. E. Spectrum Analysis. London. 1869.

Classical.

VOGEL, H. W. Practische Spectralanalyse irdischer Stoffe. Berlin. 1889.

A helpful book for self instruction or for teaching.

See Graham-Otto's Ausführliches Lehrbuch. Vol. I, Physikalische Lehren. Parts 1 and 2. Braunschweig. 1886.

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Annalen der Physik und Chemie. [Poggendorff's Annalen.] Leipzig. 1790-1895.+

The most important chemico-physical journal of Germany.

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HOPPE-SEYLER, FELIX. Handbuch der physiologisch- und pathologisch-chemischen Analyse, für Aerzte und Studirende. Berlin. 1883.

Also in French. Paris. 1877.

Handbuch der Physiologie. Von L. Hermann. Leipzig. 1879-'82. 6 vols.

A comprehensive reference book.

Physiological Chemistry. Serial.

Zeitschrift für physiologische Chemie. Hoppe-Seyler. Strassburg. 1877-'95.+

Technical Chemistry.

BOLLEY'S Handbuch der chemischen Technologie. Braunschweig. 1862-'95. 8 vols. and 49 parts. Neue Folge.

Voluminous and prepared by specialists of eminence.

GIRARDIN, J. P. L. Leçons de Chimie élémentaire appliquée aux arts industriels. Paris. 1860. 5 vols.

LUNGE, GEORG. Theoretical (A) and Practical Treatise on the Manufacture of Sulphuric Acid and Alkali. London. 1879-'80. 3 vols. Illustrated.

Eminently practical, by an authority in technical chemistry.

OTTO-BIRNBAUM'S Lehrbuch der rationellen Praxis der landwirthschaftlichen Gewerbe. Braunschweig. 14 vols. 1875-'87. Illustrated.

An extended series of independent treatises. Indexed.

SADTLER, SAMUEL P. Handbook (A) of Industrial Organic Chemistry. Philadelphia. 1896.

Has been honored by translation into German.

WAGNER, RUDOLF VON. Handbook (A) of Chemical Technology. Translated from the German. London. 1892.

A standard work.

Technical Chemistry. Serials.

Jahresbericht über die Fortschritte der chemischen Technologie. J. R. Wagner. Leipzig. 1855-'95.+

Invaluable for reference.

Jahres-Rundschau über die chemische Industrie. Wien, Leipzig. 1894-'95.+

Journal of the Society of Chemical Industry. London and Manchester. 1882-'95.+

Polytechnisches Journal. Dingler. Stuttgart. 1820-'95.+

A veteran among journals of its class.

Theoretical Chemistry.

COOKE, JOSIAH P. New Chemistry (The). New York. 1884.

In popular lecture style; has had great success.

COOKE, JOSIAH P. Principles of Chemical Philosophy. Boston. 1881.

A useful textbook.

MEYER, LOTHAR. Modern Theories of Chemistry. Translated from the German. London. 1888.

A valuable presentation of the subject by a master mind.

MUIR, M. M. PATTISON. Treatise (A) on the Principles of Chemistry. Cambridge. 1884.

An excellent compendium.

REMSEN, IRA. Principles of Theoretical Chemistry. Philadelphia. 1893.

WIECHMANN, F. G. Lecture Notes on Theoretical Chemistry. New York. 1893.

A useful elementary text book.

WURTZ, ADOLPHE. The Atomic Theory. London. 1880.

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Valuable; much criticised for its opening sentence: "La chimie est une science française."

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BLYTH, ALEX. W. Poisons, their Effects and Detection. London. 1884.

This forms Vol. II of "A Manual of Practical Chemistry." See same author under FOOD CHEMISTRY.

DRAGENDORFF, GEORG. Gerichtlich-chemische (Die) Ermittelung von Giften in Nahrungsmittein. Göttingen. 4th edition. 1895.

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WORMLEY, THEODORE G. Micro-chemistry of Poisons. Philadelphia. 1885. Illustrated.

Valuable, and well illustrated.

TROUT FARMS IN BOHEMIA.*

The growth of the population in the Eastern, Middle and Central States of the American Union, together with the decline of profits in the larger forms of agriculture there, has already turned the attention of farmers and landowners to sources of support very different from those by which the old population lived, but fish as a marketable farm product is still neglected.

I need not refer to results obtained by the United States Fish Commission, nor to efforts on the part of States to stock their own rivers, lakes, and ponds. I speak more particularly of the brooks, watercourses, and chains of small clear water lakes in the United States now in private hands or the property of cities, towns, corporations, and clubs, which add nothing to the wealth of the country by being intelligently farmed, thus failing to furnish the local markets with fresh fish at reasonable rates.

I have the honor to send you herewith a series of illustrations of a practical plan for laying out a small fish farm, suited to small brooks or streams and capable of producing trout, salmon trout, landlocked salmon, grayling, and their several crosses and interbreeds; also black bass and other fish that need clean, lively, and cool water in which to prosper.

It is a system proposed by Mr. Karl Wozelka, a practical fish grower, living in Iglau, Bohemia. It has just appeared in Nos. 28 and 31 of the Deutsche

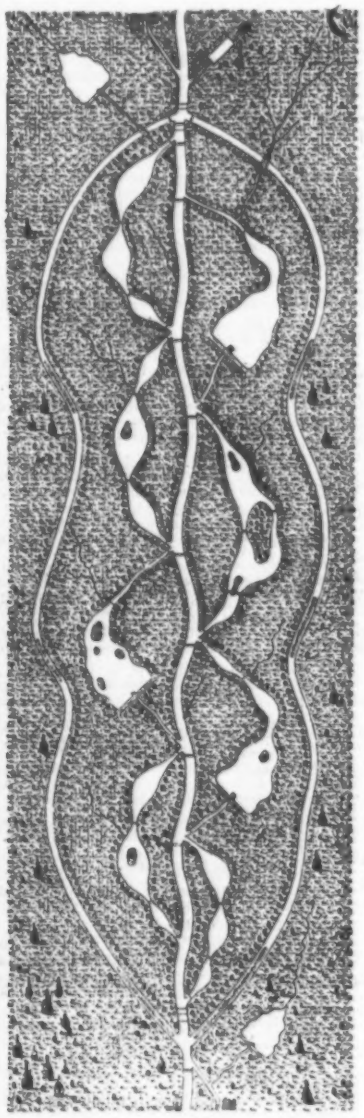


Fig. 1.—WOZELKA'S PLAN FOR FISH FARM.

Landwirthschaftliche Presse, under dates of April 6 and 17. To the illustrations I add a digest of the text supplied by the author.

Fig. 1 shows a trout farm adapted to a mill stream or ordinary brook. The middle line is the smoothed and straightened natural bed; the two embracing side canals are artificial courses to carry off the water in freshets; the ponds between these "escapes" and the brook itself are artificial breeding ponds, with sluices at their narrow parts to admit and drain off water slowly from and again into the brook. Observe that there are sluice dams down the brook at intervals and that canals into and from the breeding ponds on opposite sides of the brook never issue at the same spot, in order to avoid too great a rush of water.

The first object to be sought is to control the water of the stream in such a way that freshets and droughts will not materially change the levels in the various sections of the system, in such way, moreover, that without affecting the rest of the system, the main bed itself, or any part of the system, may be laid dry when required, the fish taken out and repairs made to bottoms, sides, sluices, and gratings, while the rest of the system remains full of water. The bed of the stream itself, as well as the bottom of the artificial branches and the sloping sides of canals into the breeding ponds, should be made uniform, so that, as the water is gradually shut off from a given part, there will be no pockets of water left and the fish will assemble toward the lower end, where they can be more easily handled. The next object is to keep out the natural enemies of small fish, such as pickerel and larger fish of the same species.

Figs. 2 and 3 show, in front view and a profile, the kind of sluices recommended, over which the water falls, thereby adding to the aeration of the water and giving fish the bubbly live water they like, and through which, by means of the oval hole, fish can ascend the stream when they wish. These sluices must be frequent in a brook with a sharp pitch; fewer are needed in a quieter flow.

Fig. 4 is a solid permanent grating of galvanized wire flush with the banks, to prevent the fish from escaping up or down stream. They are permanent at the upper and lower waters of the trout farm.

Fig. 5 is a wooden dam brought into play when the water is to be shut off entirely from a canal that feeds or empties a breeding pond.

Fig. 6 shows the head of the farm from a bird's eye view. On the right, two surface rakes to catch logs and branches; in the center, the arrangement for distributing superfluous water right and left around the farm as soon as it tops the dams; to the left, the permanent sluice gate, which controls the supply to the brook and surrounding ponds, and, just below it, the upper wire grating that prevents the fish from escaping up stream.

Fig. 7 shows two sections in profile with solid sluices down and the water remaining in each collected

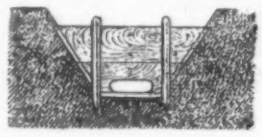


Fig. 2.—SLUICE WITH FISH RUNS (FRONT).

toward the lower end for convenience of taking out the fish.

Fig. 8 is a section of a canal, with bundles of fagots resting in holes in its bed. These fagots form refuges and breeding places for swarms of fresh water shrimps, the natural food of small game fish.

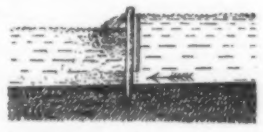


Fig. 3.—SLUICE WITH FISH RUNS (SIDE).

For such a farm the California rainbow trout is particularly recommended, owing to its rapid increase in size and weight. Crosses between brook trout and salmon trout and between salmon and trout should be tried. The best way to begin is to buy fertilized eggs and hatch them in boxes with falling water and sandy,

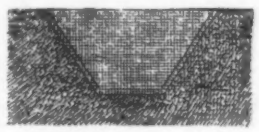


Fig. 4.—PERMANENT FISH GRATING.

gravelly bottoms, where many nooks and crevices are arranged in which the fry can hide. After the fish grow large enough they get worms, grubs, and living insects. With abundant food, from twenty to thirty young growing fish can be allowed to the cubic yard of water.

Natural feed can be arranged as follows: Colonies of

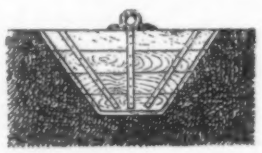


Fig. 5.—TEMPORARY WOODEN DAM.

the fresh water shrimps can be reared in holes in the canals, and protected from extermination by clumps of fagots kept in place by stones (see Fig. 8). When this food is needed in quantity, these fagots can be hoisted up and shaken out on a piece of cloth; the crustaceans are then fed to the fish. Along the ponds and canals growths of willow should be planted, partly to provide shade and partly to attract insects that lay their eggs in water and fall in themselves. Caterpillars, beetles, and other creatures that frequent willows are easily shaken into the water at night or in the early morning from the rows of young trees. Grasshoppers can be driven into the water by beating the copse at noon; the fish eat them greedily. Besides the willows, it is well to have floating boards to give the necessary shade, especially in so sunny a land as the United States.

In order to keep a single pond or a series of ponds apart for the use of certain fish, iron gratings like those that guard the whole farm up stream and down stream (see Fig. 4) can be firmly planted where the water enters from the brook, and where it flows out again into the brook. Observe that these entrance and exit canals should be made of the same size, so that the gratings, dams, and closing sluices may also be of one size, a spare one being always ready to replace a broken or defective one, or to plant it where it will stop or regulate the water supply. To prevent the side escapes during freshets from being bored out by the rush of water, or when it is necessary to lay the brook itself dry, these canals should be grassed over, or, if that is not practicable, set with stones, so that the water falls from stone to stone. To lay the brook's bed dry, it is only necessary, beginning down stream, to close off the side ponds with solid board dams (Fig. 5), two or more to each canal, according to the pitch of the canal, thus closing entrance and exit, gradually working up stream till all are cut off. Then the main sluice or water gate shown in Fig. 6 is gradually worked down until the water flows off right and left around the farm and rejoins the brook below. As the level sinks in the brook, the fish huddle toward the lower permanent grating, where they can be netted and placed in tanks, or killed and packed in ice.

Owing to the cannibal instincts of game fish, it is necessary to have the inhabitants of one part of the complex all of the same age, otherwise the little ones disappear. Of course, the water must be clean and bright; the springs that feed the brook should be under the control of the farmer. When fish are present in great numbers, they naturally require more food than the brook itself affords, while abundance of food brings them quickly to the right size for the market. One part of the farm may be adapted to raising other than game fish. It is possible to raise carp, for instance, on the same farm, assigning to that fish any low-lying muddy pond which might be too sluggish a place for trout.

This system is applicable to land above mills which owners possess or control for mill purposes; to parks

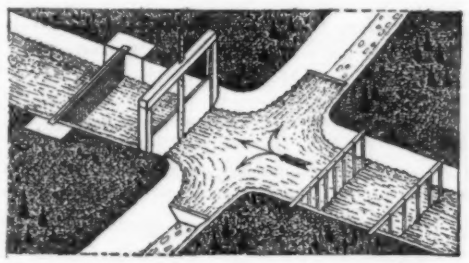


Fig. 6.—HEAD OF FARM, WATER GATE, GRATING, AND SIDE ESCAPES.

and reservations near towns and cities; to lands owned or leased by fishing clubs or by corporations like that of Tuxedo Park, N. Y., where trout hatcheries and runs already exist. Many hilly districts, no longer valuable for their wood and never to be reclaimed for agriculture, might be made by this means a source of profit to their owners. The same may be said for many small lakes, now only used to produce ice, which are already owned and improved with buildings where guards could live, thus saving many large expenses at the outset. It is nevertheless true that, when such a farm is once under way, it can be carried on at a minimum of cash outlay.

Of course, no man who gave labor and money to the

Fig. 7.—SECTIONS EMPTIED TO CLEAR OF FISH, REPAIR, ETC.

founding of a fish farm would be likely to suppose that such an establishment needs little care and wit to keep in condition and make profitable. Fish cannot be left to themselves; they must be guarded from poachers by night, two-legged and four-legged. In our land, wild and tame cats, mink, weasels, and musk rats, certain birds and snakes prey on fish. Even the twilight-loving Mephitis americana is said to like fish. The larvæ of certain insects devour the spawn, and the "boatman" beetle, which swims as swiftly as it flies, kills the newly hatched fry with its sharp beak. The

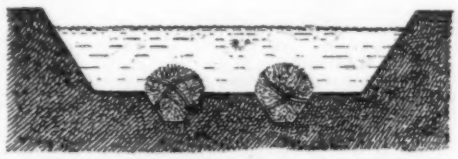


Fig. 8.—CROSS SECTION, WITH NESTS FOR LIVING FISH FOOD.

fish farmer must study the points of his own locality and adopt measures to meet his own difficulties, which will vary greatly, according as his land lies near towns or in woody regions—in places where wild creatures, or men, are more to be feared.

Fish grown for profit are also liable to sudden epidemics, and will sometimes die in masses. When this occurs, the fish farmer generally lays it to the malevolence of some jealous neighbor, who has poisoned the water. In fact, sometimes this may occur; hence the wisdom of a night patrol, by whom marauders of all kinds can be checked. But very often the disaster is entirely due to natural causes, the growth of some obscure plant, or the poisoning of the water from some unknown source.

In France and Germany, the crawfish is considered a great delicacy and is often carefully preserved and sent to market. Since these lobster like inhabitants of fresh water streams are slow growers, they must be well grown before they can be introduced into ponds and streams where fish are of any size, otherwise they merely afford so much extra food for the fish. They also devour fish spawn and fry. Doubtless the European variety would flourish in most parts of the United States where the winter is not too severe and the summer not too hot.

In conclusion, I would like the attention of land and water owners, of railway magnates and handlers of fish called to the fact that, in Germany, fish in large quantities are brought from a distance alive in tanks by rail.

* From Consular Reports No. 180.

The prices paid for live fish fully justify the expense. Should the farming of fish extend in some favored locality, it would pay railways to carry tanks or even build tank cars for the transportation of fish alive to the great centers of population, the water being kept in condition by some simple mechanism which drives air through it constantly. Much higher prices will be paid for fish arriving alive in our great city markets than for the freshest looking fish packed in ice.

CHARLES DE KAY, Consul General.

Berlin, April 19, 1895.

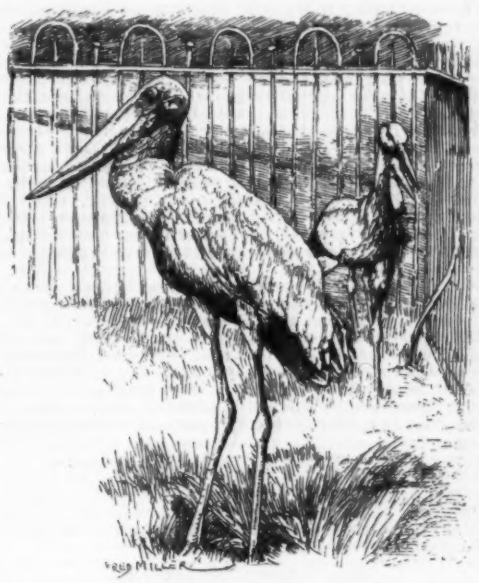
THE ZOO HERONRY.

IT may be news to some readers that a heronry is to be seen in London. True, it allows not of its inhabitants complete liberty, since even the Zoological Gardens grants not its denizens perfect freedom. But this limitation admitted, you have a heronry wherein birds nest, rear their young, and have probably better times than they would have in the open. For it is an ascertained fact that birds live longer captive than free. The place contains the common British heron, whereof there are several specimens, the night heron, flamingos, ibises, oyster catchers, spoonbill, and numerous other waders. The big aviary boasts a small lake, rocks and trees. During the present year night herons and ibises have been bred. To me it is ever one of the most attractive features of the gardens; and I am astonished people with parks neglect this example of keeping birds in a semi-wild state. Such a heronry would be an adjunct both beautiful and interesting to any grounds. For none can fail to obtain due value out of a collection of birds living happily together as in the Zoo. The keeper, Church, has been in the Gardens close on forty years. Like most of his class, he undertook the work, without any previous training, when a young man from the country, and he has remained at it ever since. He has a good many specimens under his care, because in addition to the two large aviaries he attends to the pelicans, storks, cranes and pigs. It is a pleasure to go through this portion of the menagerie with him, since you see how tame many of the birds are with him. Particularly is this the case with two of the hornbills: they are uncouth, unwieldy birds, and yet the keeper can do well-nigh anything with them. The dexterity of one in catching fruit thrown to it must be seen to be appreciated. The larger of the two is almost a nuisance, for when Church is cutting the food it persists in pulling his coat and making its presence felt in many ways. The Marabou storks are the only representatives of the large storks at present in the Zoo, as the last of the adjutants Marks painted had to be killed last year, after eighteen years in the Gardens, as one of its legs became diseased. I enjoy sitting in Church's room, listening to his genial gossip about the men of note who have visited the Gardens, and about the various interesting specimens that have been in his charge from time to time. He showed me a large deformed feather, one of several he has picked up, shed by a pelican. In the quill were some hard pellets that rattled about, and at first he thought these were shot which had got there through the bird having been fired at before its arrival. He asked Huxley last year what was the cause of this peculiarity, and was at once informed that what he fancied shots were pellets of congealed blood. This was probably the last time the professor was in the Gardens.

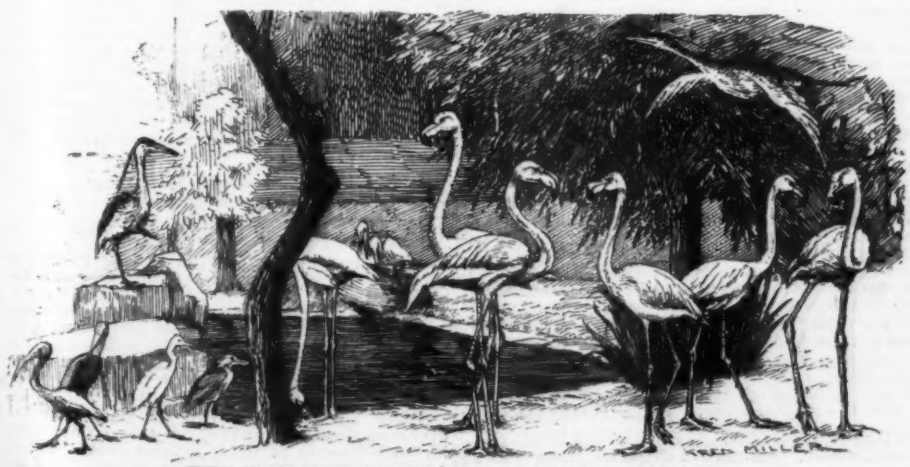
KEEPER WITH FAVORITE HORNBILL.

Church has in his room a parrot given to him because of its savage disposition, and by patience and kindness he has tamed the bird so that he can hold it in his hand. I notice that a fine black cat invariably appears when the meat is brought for the flesh-eating birds, and Church always gives him a few morsels. Puss never attempts, so he told me, to get at any of the birds, though a stray cat that took to living in the Gardens some time back had to be destroyed on account of a habit of pouncing on them. In the winter many of the birds have to be kept indoors, owing to their natural habitat being warmer; but it has been remarked that both birds and beasts which experience no cold in the wild state appear not merely to endure but to enjoy frosty weather in the Zoo. It is plain that they have the power of adapting themselves to new conditions—getting a plentiful and regular supply of food may compensate to some extent for other disabilities—and this is a hopeful fact for those who contemplate ostrich rearing in this country. I have endeavored in my drawings to give some idea of the heronry and its inmates, in the hope of interesting the great world of London in what, as I have said, is to me one of the supreme attractions of the Zoo.—Fred Miller, in Black and White.

MARABOU STORKS.



TARBIOU AND WHITE STORKS.



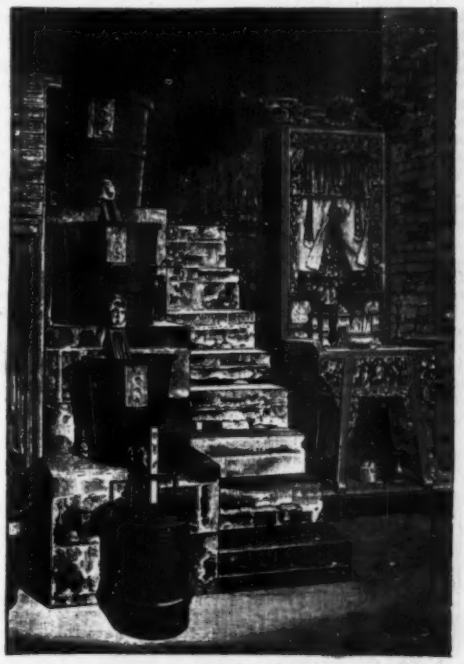
THE HERONRY, ZOOLOGICAL GARDENS, LONDON.

THE TIME IN CHINA BY SUN, WATER AND FIRE.

VARIOUS methods of measuring time were known to ancient Chinese civilization. Astronomy, which plays so preponderant a role in China, and according to which public or private acts are regulated, necessitated a search for instruments capable of measuring the procession of the stars with precision.

It was necessarily the eternal natural means that were employed. The sun, water, and fire were their chronometric means from remote antiquity, and it was not until modern times, and accidentally, that they occupied themselves with mechanical clockwork. We propose to make known the structure of the various instruments that they used and the part that these played in their customs. But before explaining how they measured time, we must tell how they divided it. As far back as the year 2337 B. C., the Chinese astronomers were able to recognize the two equinoxes and the two solstices for the length of the days and nights, to divide the year into four seasons, and to fix its length at 365 days and 6 hours, which every four years had to comprise 366 entire days. They divided the days into 12 nearly equal parts corresponding, consequently, to two of our hours. Their hours were themselves divided into parts called "kés." Each ké comprised 100 minutes and each minute 100 seconds. The 12 parts of the day were composed of six day and six night hours. The six day hours were from the rising to the setting of the sun and the six night hours from its setting to its rising. The civil day began at midnight and ended the next day at the same hour.

The Chinese employed twelve characters, which were the signs of their zodiac, to mark the twelve months of the year, the twelve days of their lunar division, and the twelve hours of the day. This same division of the time was carried from China to Japan. In the seventeenth century, under the influence of the Jesuit missionaries, and particularly that of Father A. Schall, the Chinese adopted the division of the day into twenty-four hours, of the hour into sixty minutes and of the minute into sixty seconds.



CHINESE CLEPSYDRA OF THE FOURTEENTH CENTURY AT CANTON.

Of the horary instruments, the gnomon was the one most employed by the Chinese for their observations. In the 104 B. C., says Father Souciet, Sse-matsien made known several astronomical precepts. Hohiahong, a Chinese savant, took upon himself the greater part of this work. An eight foot gnomon was used for observing the seasons, and the lapse of time between the passage of a star through the meridian was marked by a water clock.

In principle, the gnomon was a rod, a needle or any other vertical object that, through its shadow, showed the progression of the sun; and the clock or the sun dial properly laid out was made known to them only by the missionaries. The latter, it is true, found some very ancient ones, the use of which they could hardly understand, and in the account of the embassy of the Eastern Company of the United Provinces to the Empire of China, in 1665, we read:

"There are some persons that dip into the manufacture of solar clocks, but their success is so slight that it is pitiable."

The Chinese occupied themselves more particularly with clepsydras or water clocks. Certain authors carry the invention of clepsydras back to Hoang-ti, who began to reign in the year 2698 B. C. This was the emperor who had twelve bells cast corresponding to the twelve moons, in order to indicate the seasons, the months, the days, and the hours. Others attribute this primitive clock to the reign of Yao, in the year 2357 before our era. Father Gaubil, from whom we borrow the following data, says:

"In the Tchou-li, a book older than the Hans, who began their reign 202 years B. C., and which treats of customs and ceremonies, it is said that great attention was paid to marking the revolutions of Jupiter,

and that it was ordered that night time should be divided into intervals, and that at the intervals marked there should be persons to make them known by striking plates of wood, and that it should be water clocks that measured the time of such intervals."

The ancient interpreters speak of a large basin in which were seen divisions that indicated the hours or their divisions. Fires or lamps were kept burning all night in order that such divisions might be seen. Above there was suspended a vessel from which water flowed into the basin, and it was known that in a certain space of time the water would rise in the basin to a certain height.

Under the dynasty of the Tcheous (from 1122 to 225 years before our era) there was a functionary at the court named Sie-hou-che, whose special mission it was to regulate the clepsydras. Duke Tcheou, youngest brother of Vououang, first sovereign of the afore-aid family, and a semi-historic individual, appears, according to the Chinese, to have been the first to surround the instrument with warm water supplied by a furnace placed at the side in order to prevent it from freezing in winter.

These clepsydras consisted of two copper basins placed one above the other. The clepsydras were perfected in time and consisted of four vessels. The tubes through which the water made its exit were in the form of the jaws of dragons or other animals.

Chinese authors of the sixth century speak of a clepsydra whose water flowed out gradually through the bill of a bird and fell into a receptacle placed upon a balance. One pound represented one ké. At about the same epoch mercury began to be used instead of water, and this rendered the use of warm water unnecessary in winter. It was toward the year 104 of our era that the Chinese constructed astronomical clepsydras composed of a sphere with the signs of the zodiac, etc. The Emperor Hiouan-tsong, in the year 721 B. C., called to him Y-hang, a bonze astronomer. History boasts of a brass instrument that he caused to be constructed and which gained for him the eulogium of the court. It was water that caused the motion of both the sun and the moon, as well as the occultations of the stars and planets. There was seen indicated therein the relative length of the days and nights, the height of the pole and of the stars visible and invisible upon the horizon. Two styles marked day and night, the kés and the hours. When the style was upon the ké, a small wooden statuette was seen to appear quite unexpectedly. This statuette struck a drum and then disappeared. When the style was upon the hour, another wooden statuette appeared in turn and struck a bell, after which it retired.

The Canton clepsydra, a photograph of which we owe to the kindness of Mr. Imbault Huard, a French consul, is a copper vessel called t'oung-lou-ti-leou, from which water flows drop by drop. It is found in a pavilion built upon a double arch that crosses a street running from the great southern gate of the city to the palace of the treasurer of the province. Like the one that existed, and may still exist, at the observatory of Pekin, it consists of four copper vessels whence the water flows from one to the other through tubes arranged at their base. The vessel that stands upon the floor of the room has upon its wooden cover a sort of bridge traversed by a rule mounted upon a float and upon which are indicated the figures of the hours. After the water has flowed out, that is, in the morning and evening, it is emptied into the uppermost vessel. There is a small brick stairway that allows the attendant to reach it. The following are the dimensions of the vessels:

Nos.	Diameter, inches.	Height, inches.
1.	23	23
2.	22	21
3.	21	20
4.	23	19

According to the Chinese Repository, the clepsydra is surmounted by an altar dedicated to Pan-Kou, the Chinese Adam, who, for some reason unknown, is regarded as the tutelary god of it. At the right there is another altar, that of the goddess Kouan-yn.

At the beginning of every hour the guardian affixes to the outer side of the door a placard bearing the names of the hours in black Chinese characters upon a white ground. The guardian is obliged, besides, to strike upon a bell in the day time and upon a gong at night all the hours found in the clepsydra room. This guardian occupies his leisure hours in the manufacture of incense sticks upon which the hours are marked, and increases his small salary by selling them to the public and to watchers.

The vessels of the Canton clepsydra date back to the year 1316 of our era. The Emperor Chim-li, who reigned from 1333 to 1367, had in his palace a large cabinet surmounted by what was called the "Niche of the Three Sages." In the center of this cabinet was placed the figure of a young girl who held the needle that served to mark the hours of the day and night, as well as the kés. When the needle was upon the hour, a column of water escaped. On the two sides were also seen two angels, one of which held a bell in the hand and the other a copper basin. When the time of the night had arrived, these two figures beat the Chinese vigils conformably to the time marked by the needle. Several statues representing lions and eagles were in motion at the sides. To the east and west of the cabinet was seen the path of the moon and sun in the zodiac.

In front of the figure that represented the twelve signs were six ancient immortals. At noon and at midnight, these six statues walked in pairs, crossed what was called the "Holy Bridge," then entered the "Niche of the Three Sages," and finally returned to their first station. The emperor had the credit of inventing this wonder of art.

The Chinese, as may be seen, have, like other Orientals, constructed clepsydras with automatons, as, later on, clocks with weights or springs were constructed in the west.—La Nature.

MEDICAL AUTHORITIES assert that crying is the chief and best exercise for young children, and one hospital superintendent says that a healthy baby should cry three or four times a day at least, and from ten to fifteen minutes at a time.

WEATHER FALLACIES.*

IN the long and patient pursuit which the attainment of all accurate knowledge exacts from man, it may sometimes be instructive to turn one's gaze backward and contemplate the errors which have been corrected, the fallacies which have been demolished, and the superstitions which have been lived down; and this consideration has prompted me to take for the subject of this year's address that wide range of human opinions which may fitly be classed under the head of "Weather Fallacies."

Nothing could have been more in accordance with the law of growth in other branches of knowledge than that meteorology should, in its earliest dawn, have been with difficulty able to emerge from the mists and darkness of guesses and surmises such as have surrounded the transfer of any truth from the barbaric to the philosophic stage.

It is to the Greeks that we must look for the first real weather observations after the matter had passed through what may be called the mere savage phase; and we find Hesiod, Theophrastus, and Aratus presenting us with an early code of rules, which serve at least to show us how little we have ourselves advanced in some matters since their time.

One of our Fellows, Mr. J. G. Wood, has just given to the world an excellent and scholarly translation of the work of Theophrastus, which has not previously been put in an English garb, and Mr. Wood has done the whole country a great service in giving us this translation of the "Winds and Weather Signs," a book which contains a host of rules and observations about the weather, and which, as might be expected from the production of the favorite pupil of Plato and Aristotle, is singularly free from errors of the grosser and more superstitious kind, such as were plentifully produced in Western Europe many centuries later.

But long before the time of Theophrastus, and probably very soon after the invention of agriculture itself, there were weather gods and weather fallacies; for we find that Jupiter Tonans and Pluvius, the thunderer and the rain maker, were set by men on the highest pedestals. And centuries after this, Lucian tells us that it was usual in his time to offer prayers for suitable weather, and he recounts in his "Dialogues" how two countrymen were at the same time offering up contrary petitions, one that not a drop of rain might fall until he had completed his harvest, while the other prayed for immediate rain, in order to bring on his backward crop of cabbages—both suppliants only too sure to find that the ears of the image were deaf as the stone of which they were made, and that the wheels of the universe would not wander or turn back for any selfish ends of man.

In considering these early times, when the weather had to be studied from cloud, sky and sea, and from the behavior of the animals and plants, we must be ready to excuse men for doing that which is still too frequently a cause of error, viz., foretelling what they most wished for, and putting down as universal law that which was only a coincidence of totally independent events. In considering weather fallacies it will be impossible to follow a chronological order; so I shall treat them, or rather a small portion of them, under the heads of saints' day fallacies, sun and moon fallacies, and those concerning animals and plants, while I finally shall consider the almanac makers, weather prophets and impostors, who have from time to time furnished the world with materials for its credulity or its ridicule.

The first class of weather fallacies, which I shall scarcely more than mention, are those which refer to the supposed connection between the weather of any day in the week or year and that of any other period, and it may be as well to state at the outset that there is no kind of foundation in fact for any of these so-called rules. They are for the most part born of the wish to see certain kinds of weather at certain times of the year, and, like all these predictions, were faithfully remembered when they came true, and promptly forgotten when they failed. One has often heard—

"Fine on Friday, fine on Sunday."

Or that "Friday is the best and worst day of the week," and the superstition even extends to hours of the day, for we have—

"Rain at seven, fine at eleven,"

which is only another way of saying that rain does not usually last four hours, and the rule generally fails when applied to daily experience; but the host of proverbs connected with saints' days are more difficult to deal with, on account of the longer time which elapses between the prophecy and its fulfillment or failure. All or most of these proverbs concern the days of certain saints, though I think no one imagines that this is anything more than a convenient method of fixing the date, because our ancestors had a saint for every day, so that they naturally referred to the day by his name.

There are forty weather saints, among the most prominent of whom is undoubtedly St. Swithin, whose day is July 15, and the superstition is that if it should rain on that day, it will rain for forty days after. Now, as Mr. Scott observes, this date is very near a well known bad time in wet years, as the terms, long in use, of "St. Margaret's flood" and "Lammas flood" abundantly testify. The fact that some of these heavy rains began on July 15 has been enough material for the adage monger, and so we have another "universal" law laid down, a law which is, however, constantly broken, as every student of the weather very well knows. The whole thing is a fallacy of the most vulgar kind, and ought speedily to be forgotten, together with all the adages which make the weather of any period depend on that of a distant day.

Turning in weariness from this class of superstitions, which may be said to belong to the self-exploding order, we are next met by an extensive array of authorities who, under the protecting shield of astronomy, profess to have framed infallible rules for the weather as judged from the ever varying relative positions of the sun, moon and planets. They attack us systematically and persistently, appealing to analogy, to reason, and to common sense. But it is sometimes necessary to be on our guard, even against common sense, in considering problems to which uncommon sense has for centuries been devoted without avail. The well known action of the sun and moon upon the ocean tides is generally the starting point of these theorists, and it is soon shown to common sense that when the earth is nearer the sun, or the moon is nearer to the earth (it being remembered that they move in elliptic orbits), or when both sun and moon are, as it were, pulling together, as at new moon, there ought to be a tide of atmosphere caused by their influence similar to the tides of the ocean, which such agencies undoubtedly produce. But we find that whatever so-called reason, analogy, and common sense may seem to dictate, the facts will not follow in the path marked out for them; and the atmospheric tides refuse to ebb and flow, except in a most infinitesimal degree, quite disproportioned to their supposed moving forces. The theorists must try again, and they do so by pointing out that the moon and earth move in planes which are inclined to each other at an angle, and that at some times of the year the attraction of the sun and moon are acting in somewhat widely diverging lines, while at others they are pulling more nearly in the same plane. Here is, they say, a clear case. At times, when the angle is greatest, there should at any rate be worse weather caused by the conflicting forces. When the moon is said to be "on her back," or, in other words, when the line of the shadow boundary of the half moon or crescent is much inclined to the earth's axis, then is the time, say they, for tempests and commotions to come. But again the spirits from the "vasty deep" do not come when called, and we have to invent other causes for our earthly disturbances.

It may be safely said that a new moon theory as to the weather comes out at least once a year, and it has been attempted to connect the honored name of Sir William Herschel with a table which professed to show the dependence of weather changes on those of the moon.

By the kindness of Mr. Symons I am able to show you on the screen a much magnified representation of this production, now very scarce, and which has the name of Herschel in large capitals, no doubt as a sort of ballast to give it weight and steadiness, though it does not definitely state that Herschel had anything to do with it. Herschel's own letter on the subject runs as follows:

"Sir: I am glad of an opportunity to say that prognostications of the weather are so much above the knowledge of astronomers, that I have taken uncommon pains publicly to contradict reports of predictions that have been ascribed to me. You may, therefore, be assured that what you have heard as my opinion about the frost is without the smallest foundation. If at any time Slough should be in your road, I shall be very glad to see you here, and remain, sir, your most obedt. servt., WM. HERSCHEL.

"Slough, near Windsor, February 6, 1814."

So that any Fellow of this Society who sees one of these diagrams in the future will know that it is a fraud.

Of course it is in the power of every one to check the predictions which are so often issued with respect to the changes of the weather taking place at the change of the moon; but many eminent men have occupied themselves with the subject, and the result is that no correspondence between the two classes of phenomena has been established.

Dr. Horsley examined the weather tables of 1774, as published by the Royal Society, and out of forty-six changes of weather in that year, only ten occurred on the days of lunar influence, only two of them being at the new moon, and none at all at the full. M. Flarguergues, of Viviers, found also as the result of twenty years' observations, that the barometer readings taken when the moon was furthest from the earth averaged 755 millimeters, and when nearest, 754 millimeters, showing a difference of 1 millimeter or about 0·04 inch, and this in a direction against the theory, the pressure being greater by that amount when the moon was farthest from the earth.

Various other weather seers have pinned their faith on lunar cycles, and have predicted that weather changes would repeat themselves, as soon as the sun and moon got back into the same relative positions, which they do in nineteen years, with only an error of an hour and a half. Others, such as Mr. G. Mackenzie, advocated a cycle of fifty-four years, but it may be summarily stated that all the cycles have broken down, and that, as far as we know, there is no definite period after which the weather changes repeat themselves.

Other fallacies about the moon are numerous, such as that the full moon clears away the clouds; that you should only sow beans or cut down trees in the wane of the moon; that it is a bad sign if she changes on a Saturday or Sunday; that two full moons in a month will cause a flood; that to see the old moon in the arms of the new brings on rain, and many others, of which a catalogue alone would take up a good deal of space. M. Flammarion says that "the moon's influence on the weather is negligible. The heat reaching us from the moon would only affect our temperature by twelve millionths of a degree; and the atmospheric tides caused by the moon would only affect the barometric pressure a few hundredths of an inch, a quantity far less than the changes which are always taking place from other causes." On the whole we are disposed to agree with the rhyme which thus sums up the subject:

The moon and the weather
May change together;
But change of the moon
Does not change the weather.

Even the halo round the moon has been discredited, for Mr. Lowe found that it was as often followed by fine weather as by rain, and Messrs. Marriott and Abercromby found that the lunar halo immediately preceded rain in thirty-four cases out of sixty-one. We always have a lingering hope that some future meteorologist will disentangle the overlapping influences, and arrive some day at a definite proof that our satellite after all has something to do with our weather.

About the sun, also, there are many fallacies, and ever since the discovery that the spots which appear on his surface have a period of greatest and less frequency, there have been theorists in shoals who have sought

* An address delivered to the Royal Meteorological Society, by Mr. Richard Inwards, president. (Reprinted from the Quarterly Journal of the Society.)

to prove that this fact rules our weather. It has undoubtedly been found that the frequency of sun spots and the variations of the magnetic needle are intimately connected; and it is almost equally well established that the aurora appears and disappears in some sort of sympathy with the sun spot variations. But this, up to the present, is as far as we can get in this direction, for our weather seems to have no definite relation to these changes.

The more recent discoveries of prominences visible round the disk of the sun during an eclipse, and of the light clouds only seen in M. Deslandres' spectro-photographs, will no doubt call out new weather theories on the subject. And I must confess to a wish that those mysterious flame-like bodies rushing from the sun millions of miles into space will be found to have some influence on the upper layers of our earth's atmosphere; but I also hope that we may be saved from a theory on the subject until more facts are before us.

Coming down to earth again, we are met by a long array of fallacies connected with the behavior of animals and plants, and which have a supposed connection with weather changes. Few of these are so well grounded that they may be considered as proved, and as nothing is sacred to a meteorologist, our veteran fellow, Mr. E. J. Lowe, F.R.S., has endeavored to put some of the rules from this source to the test of definite observation. He took a number of well known signs said to indicate change, and carefully noted what happened after each sign, and although he does not say that all indications from animals, birds and plants are useless, yet certainly those he did investigate seemed utterly to break down.

He took the well-known signs of bats flying about in the evening, many toads appearing at sunset, many snails about, fish rising much in lake, bees busy, many locusts, cattle restless, landrails clamorous, flies and gnats troublesome, many insects, crows congregating and clamorous, spiderwebs thickly woven on the grass, spiders hanging on their webs in the evening, and ducks and geese making more than usual noise. Mr Lowe found that in 361 observations of the above signs, they were followed 213 times by fine and only 148 times by wet weather; so that even after the prognostications for rain, there was a greater preponderance of fine weather. He called a day fine when no rain was measurable in the rain gage. Mr. Lowe says that even swallows flying low cannot be depended on, as, especially at the close of summer and autumn, they almost invariably skim the surface of the ground, and Mr. Charles Waterton, the naturalist, decided, after careful observation, that the unusual clamor of rooks forms no trustworthy sign of rain. These must, therefore, swell the list of fallacies, although there are many other rules which have not been so carefully examined, but which may still be true. My own impression is that although it is painful to dismiss the animals from their ancient position as weather prophets, we may consider them as indicating what they feel, rather than as predicting what is to come, and that their actions before rain simply rise from the dampness, darkness or chilliness preceding wet weather, and which render these creatures uneasy, but not more so than they affect man himself. The sheep turning its back to the wind (one of the best known signs of rain) is probably only that it may shelter its least protected part from the effects of the weather; and many of you must have observed sheep sheltering their heads from the heat by getting them into the shade of each other's bodies in a similar way.

As to cows scratching their ears, and goats uttering cries, and many other signs of bad weather, they are at least very doubtful; while the adage about the pig, which credits him with seeing the wind, carries with it its own condemnation.

The medicinal leech is still left on the list of weather prophets, though he has no doubt had his powers exaggerated; and two books have been written about his behavior during changes of weather. One is by Mrs. Woollams, who, during a long illness, watched a leech in a bottle, and carefully noted what it did; and the other is by a gentleman at Whitby, who came to the conclusion that the leeches could be made to give audible and useful storm warnings. So he contrived the instrument of which I now show you a drawing taken from his book. No one would imagine from its appearance what its use could be. It consisted of twelve glass bottles each containing a leech in water, and so arranged in a circle, in order, as the human inventor states, that the leeches may see each other and not endure the affliction of quite solitary confinement—this rather reminds us of Isaac Walton, who told his pupil to put the hook into the worm "tenderly, as if he loved it;" in each bottle was a metal tube of a particular form, and which was made somewhat difficult for a leech to enter, but into which it would endeavor somehow to creep before a thunderstorm, according to its nature. In each tube was a small piece of whalebone, to which a gilt chain was attached, and so arranged, on the mousetrap principle, that when the whalebone was moved the bell at the top of the apparatus was rung by means of the chain. There were twelve leeches, so that every chance was given that one at least would sound a storm signal. The author called this apparatus the "Tempest Prognosticator," a name which he preferred —and I think we shall agree with him—to that of atmospheric electric telegraph conducted by animal instinct. He went on to state in his little book that he could, if required, make a small leech ring the great bell of St. Paul in London as a signal of an approaching storm. The book is written in all seriousness, and a number of letters are appended from gentlemen who certify that correct atmospheric indications were at various times given by the leeches. The name of the inventor of this ingenious contrivance was Dr. Merryweather—himself a learned leech.

Plants have also their advocates as weather indicators; and there is no doubt that in most cases they act in sympathy with changes in the dampness, gloominess, or chilliness of the air, and as these conditions generally precede rain, one cannot term the indications altogether fallacious. The pimpernel and the marigold close their petals before rain, because the air is getting damper, while the poplar and maple show the under surface of their leaves for a similar reason. Indeed, an artificial leaf of paper may be made to do the same thing, if constructed on the same principle as the natural one. A hard thin paper to represent the upper side of the leaf and a thicker unsized paper for the lower side: these will, if stuck together, curl up or bend down in sympathy with the hygroscopic condition of the air. A slip of ordinary photographic paper will do the same, and will curl up at once when placed on the hand.

The same slackness which moisture produces in plants applies in some degree also to insects, some of which can only fly in sunshine, so that there is a chain of weather signs all following from a little dampness in the air. The flowers close their petals and shut in their honey, the insects cannot fly so high, and the swallows seeking them skim the surface of the earth, and even then the threatened shower may not come.

In 1892 attention was directed to a plant, the Abrus precatorius, a beautiful shrub of the mimosa kind, which has the property of being sensitive in a high degree, so that its pinnate leaflets go through many curious movements, and it was claimed that these form a guide of unerring certainty to foreshow the coming weather. Even earthquakes were said to be predicted by this wonderful plant. If it closed its leaflets upward, after the manner of a butterfly about to settle, fair weather was shown; when the leaflets remained flat, changeable and gloomy weather was indicated; while thunder at various distances was to be foretold by the curling of the leaflets, and the nearer the thunder, the greater the curl, until when the points of the leaflets crossed, the thunderstorm was indicated as being overhead.

Changes of wind, hurricanes and other phenomena were to be shown by the various curious and beautiful movements of the leaflets and stalks. These movements undoubtedly took place, but when the plant was submitted to the unprejudiced observation of Dr. F. W. Oliver and Mr. F. E. Weiss, at Kew Gardens, those gentlemen failed to find any connection between these movements and the weather, and Dr. Oliver made a report on the matter, which hits the heart of the whole subject of plant movements, by ascribing them for the most part to the agency of light and moisture.

Mr. Scott, of the Meteorological Office, gave the finishing stroke to the theory by proving that the movements had no connection with either cyclones or with earthquakes, so that the sensitive plant may be considered as out of the list of weather guides, in spite of having been made the subject of an English patent.

It is a most common observation in the country that a large crop of hips, haws and holly berries indicates a severe winter to follow, and is generally pointed out that nature thus provides winter food for the birds. This, too, is a fallacy.

Another weather fallacy, for which artists are responsible, is that flashes of lightning take the form of long angular lines of a zigzag shape, and of which I show you an example, taken from a work on the subject. This, when compared with the next view, which is a photograph taken direct from nature, shows that the artist had very little understood the true form of the lightning flash, which consists of numbers of short curves joining each other, something like the course of a river depicted on a map, or in some degree like the outline of a clump of leafy trees seen against the sky. But, as far as I know, there were only two artists whose acute vision saw lightning in anything like its true form. One was Turner, who long before the time of photography scratched his lightning flashes with a pen knife, making short curved dashes across the picture; and the other was Nasmyth, the astronomer and engineer, who also saw the lightning in its true form, and duly noted the same, only to be confirmed years afterward, when it became easy to photograph the lightning flash itself.

While on the subject of lightning, I may mention that it is recorded that in one case at least a rheumatic man, who had been confined to bed six weeks, received a shock from a stroke of lightning, jumped from his bed and ran down stairs completely cured. This is related in the Gentleman's Magazine for June, 1820.

It has been often stated that the noise of cannon will produce rain, and it is not unusual in the Austrian Tyrol to hear the church bells ringing to avert thunder. These are fallacies. The experiments in America made recently to test whether rain could be produced by exploding a large quantity of gunpowder in the air resulted in nothing except noise and smoke, though the thing was well worth trying.

Empedocles of old is credited with the invention for chasing away the Etesian winds by placing bottles made of the skins of asses on the hills to receive them. Timæus relates this. After hearing this about Empedocles, one is not surprised to learn that he thought there were two suns, that the moon was shaped like a dish, and that the sea was the sweat of the earth burnt by the sun. All this will be found in Stanley's "Lives of the Philosophers."

Almost in our own time, too, a "pluvifuge," or machine for blowing away rain, was proposed in Paris. This, too, was a fallacy.

To give an account of all the various ceremonies in savage and civilized countries which have been resorted to for the purpose of changing the course of the weather, would be here impossible; but such rites have a common origin and a common result. They begin in error and end in failure.

In India, the rain god is imagined to pour down showers through a sieve; in Peru there was supposed to be a celestial princess, who held a vase of rain, and when her brother struck the pitcher, men heard the shocks in thunder. In Polynesia rain comes from the angry stars stoning the sun; while in Burma it is still the custom to haul down rain by pulling at a rope. New Caledonia has its regular rain making class of priests, and in Moffatt's time the rain makers of South Africa were held in even higher estimation than the kings; and on the other side of the world the Alaskan propitiates the spirit of the storm by leaving tobacco for him in a cave. In our own country, too, there have been weather witches of various grades, and one described in Drayton's "Moon Calf"—

> "Could sell winds to anyone that would
> Buy them for money, forcing them to hold
> What time she listed, tie them in a thread
> Which, ever as the seafarer undid
> They rose or scantled as his sails would drive
> To the same port whereat he would arrive."

The Finlanders at one time drove a profitable trade by the sale of winds. After being paid, they knitted three magical knots, and told the buyer that when he untied the first he would have a good gale; when the second, a strong wind; and when the third, a severe tempest.*

Sir Walter Scott also mentions that King Eric, also called "Windy Cap," could change the direction of the wind by merely turning his cap round upon his head; and old Scotch women are mentioned who, for a consideration, would bring the wind from any desired quarter.† The Mandan Indian rain maker had a rattle by the noise of which he called down rain from heaven by the simple process of keeping on long enough. It is safe to say that these are all fallacies.

From the rain makers we may now turn for a moment to the almanac makers, and any one who will look up an old almanac of the early part of the last century will find the greater part of it filled with lucubrations on the influence of the stars and constellations; he will also find a column giving for every day the parts of the body which are particularly under the celestial influences on the given dates, and when one sees for the first time this column reading head, chest, legs, knees, feet, etc., one wonders what it can mean; but it was then so well understood as not even to require explanation, and there was generally, too, a rude woodcut of a hideous human figure, tattooed with the various signs of the zodiac to show the same thing. The sort of knowledge that passed for meteorology in 1708 may be learned from the following extract from "Meteorologia," by Mr. Cock, Philomathemat. 1708—a rare book in the possession of Mr. Symons.

"The twelve signs are divided into four sorts, for some be earthy, others watery, a third sort aery and the fourth sort is fiery."

The author then goes on to state that "Jupiter in the Skinker (whatever that may be) opposed by Saturn in the Lion did raise mighty Southwest winds. . . . . Observe when a planet is in an earthy sign he was lately dried up by perambulating a fiery sign, and after that, immediately having made his progress in an earthy sign, is quite bound up from moisture."

It seems incredible that our ancestors, only a few generations back, could have bought, paid for and believed such stuff as this. The early almanacs boldly gave a prediction for the weather for every day in the year; but after a time confined themselves to a general statement of the weather, for instance "Partridge's Almanac" for 1835 has the following prophecy for June: "Fertilizing showers attended with thunder and lightning"—this does for the first ten days, "Fair and at times hot," for the middle of the month, and "refreshing rain for the grass and corn" for any time between the 21st and the end of the month.

Authors of weather almanacs had already begun to seek safety in vagueness. Some of these almanacs rose to a great popularity on the strength of one lucky guess; and I think it is told of this same Partridge's almanac, or some other of the class, that it owed its reputation to a curious prophecy of extraordinary weather for July 31, when hail, rain, snow, thunder, etc., were freely indicated. Forgetting that the month had 31 days, the almanac maker had omitted to insert the weather prediction for the last day, and a boy was sent from the printing office to know how the space was to be filled up. The weather prophet was too busy to attend to him, but at last in a passion, said: "Put down hail, rain, snow, thunder, anything;" and the boy taking it literally told the compositor, who duly set into type the extraordinary prediction, and which by a freak of nature came true, and made the fame and fortune of the almanac maker. This story if not true is at least ben trovato, and shows the force of the bard's statement—

> "Our indiscretion sometimes serves us well
> When our deep plots do pall."

The British Almanac for 1831, published by the Useful Knowledge Society, had no weather predictions.

Patrick Murphy published a popular weather almanac, and his fame is said to have commenced by a lucky hit in one of the earlier issues by which he indicated which would be the coldest day of the year. There is a copy of this almanac for 1838 in the library of the society, and some former owner has evidently taken the trouble to pencil in the actual weather opposite to that predicted. There were according to this annotation, 89 incorrect forecasts, 91 doubtful, and the rest correct.

This Patrick Murphy was not a mere charlatan. He had a system, and though he differed from Sir Isaac Newton and the Royal Astronomical Society, he gave much study and research to the subject of meteorology —as shown by his various books. There was an Astro-Meteorological Society as late as 1861, and we have some numbers of its Records in our library.

Next comes the subject of weather prophets as distinguished from mere almanac makers; and who profess, sometimes for pelf, at other times for honor and glory, to predict the weather for any future date. These are always arising, and they do not lack a certain number of followers, who, possessing a large angle of credence, duly trumpet forth the success of their chiefs, when they are so fortunate as to make any. The stock in trade of a prophet is of a slender and cheap description. He must have an inventive mind, a store of self-confidence, an insensibility to ridicule, and, above all, a keen memory for his successes, and a prompt forgetfulness of his failures. He should by choice have a theory, and this should be of the elastic order, so that if a predicted event does not punctually occur, he will be ready with a sort of codicil to amend it. Hence we find that the firing of guns has been cited as a sufficient reason for falsifying a weather prediction; and railways, too, are said to have an adverse influence, one author (not a prophet) telling us that they may be considered as "large winnowing machines, perpetually fanning and agitating the air with prodigious power, plowing the air, as it were, and causing waves of vast extent, which, invisibly enlarging like the waves of the ocean, probably meet each other, clash and produce modified effects, as resultants from adverse motions."

One of the first weather prophets mentioned in that

* Olaus Magnus, "History of the Goths," 1638.
† Notes to "The Pirate."

delightful old book, Stanley's "Lives of the Philosophers," was Democritus, the Milesian, known as the "laughing philosopher," who foresaw a dearth of olives, and by buying up all he could get might have made a fortune, but gave it back to the bargainers with the remark, "You can see now that a philosopher can get rich when he pleases." Then there was Pherecydes, of whom Pythagoras was a favorite pupil, who predicted an earthquake three days in advance by the taste of the water from a certain well. Perhaps the earliest of all was Elijah, who from the top of Carmel pointed out the coming squall cloud, and predicted a great rain. He forms a good model for imitation to the modern weather prophets, for he did not prophesy until he saw the storm coming, and he made no secret of his method. We have still among us in our country, mostly without honor, seers who supply us with weather predictions in various forms, from the modest duodecimo almanac to the flaring broadsheet which compels attention; but it would be a task too long to enter on a systematic refutation of their contradictory guesses at the weather. The last of these broadsheets that caught my eye had for the days of the gale of December, 1894, which Mr. C. Harding has described to us, the tame announcement of "generally overcast." This did not err on the side of boldness when considered with reference to one of the severest gales of the century.

A Spanish peasant whom I heard of in Andalucia, and who had the reputation of a weather prophet, wisely said, if you want to know the weather for tomorrow, ask me early in the morning. The Indian weather prophets who made a failure had to be silent altogether for the rest of their lives; and this causes us to regret that some of our own seers were not born in that distant land.

As to the so-called weather forecasts, they only come under the title of this paper when they fail, and as eight out of ten are said to be correct, I shall only say that they are honest attempts on the part of civilized governments to warn their people as far as possible against the march of known disturbances. I could wish that the term "weather indications" or "indicated weather" had been adopted, so as to make this plain to all, and that oftener, when the signs were vague, we had the simple announcement of no change indicated.

The director of this system so well known to us, and who is playfully called the "clerk of the weather," sometimes receives valuable hints, even from children; and I must quote one such communication:

"Please, Mr. Clerk of the Weather, tell the rain, snow and hail to stop for the afternoon and rain in the night."

I may conclude this section by saying that it is a great fallacy to suppose that there is such a thing as a weather prophet. All the great authorities agree that in the present state of our knowledge no human being can correctly predict the weather, even for a week to come.

And now we must consider a class of weather fallacies of which the victims can only excite in a well regulated mind feelings of sadness and compassion, rather than the ridicule to which at first sight they seem more naturally entitled. I mean those weather prophets in whom the delicate mechanism of the mind is touched by disorder or decay, even if it has not already fallen under the stroke of complete dementia, and who believe that they can not only foresee the weather, but, by an effort of their own minds, control the elements and compel the clouds.

These patients I had hoped only existed in small numbers; but, on perusing the correspondence of a prominent meteorologist, kindly lent me for the purpose, I find that there are many of this class whose name, like that of the ancient wanderer among the tombs, is "Legion," and who still come on, each prepared to drive the chariot of the sun, or by an exertion of his own will, odylize (the word I suppose will come) all the powers of nature.

Dr. Johnson's Astronomer says in "Rasselas:" "Hear me, therefore, with attention. I have diligently considered the position of the earth and sun, and formed innumerable schemes, in which I changed their situations. I have sometimes turned aside the axis of the earth, and sometimes varied the ecliptic of the sun, but I have found it impossible to make a disposition by which the world may be advantaged. What one region gains another loses. Never rob other countries of rain to pour it on thine own."

This type of patient, as well as those who would use their supposed power for the purpose of creating fine weather during the holidays of the people, belong to the more noble sort, but there have been others, like the notorious Friar Bungay, who for sordid reasons have professed to exert a similar power. The only wonder is that anybody ever believed them.

Now as this malady of the mind is not incurable, I will venture to offer a practical suggestion, and would recommend these patients who have nursed themselves into the belief that they possess the keys of the weather to seek the hill top on a summer afternoon—the air and exercise will do them good—and watch the fine fleeces of cumulus cloud as they sail majestically across the sky, each with its attendant shadow below. Let the patient concentrate his attention upon one single feathery cloud, and try by the exertion of his utmost force of will to make it pause for a moment in its career: and, if he fails—"as fail full well he may"—then let him banish from his mind forever the idea that he can by his own will dominate the whole firmament. And if he has ever gone into print upon the subject, let him go home, and, like Prospero, his prototype, say—

"Deeper than ever plummet sounded,
I'll drown my book,"

and so save the world from the trouble of investigating much pure nonsense. To these sufferers I can only repeat the words of one of our own kings to the last man he touched for the evil—"I wish you better health and more sense."

I must be forgiven for having only made a selection from the vast catalogue of fallacies which have accumulated about the subject, and I must continue to regret that there are still people who are ready to believe that the saints' days rule the weather, that the sun puts out the fire, that warm water freezes sooner than cold, or that a man is a prophet because he says so himself.

This society is clearing the ground of many weeds, and already the fallacy of the "equinoctial" gales has been exploded (by Mr. Scott), while the churchyard ghost of the supposed fatal "green Christmas" has been most effectually laid by a recent statistical paper by Mr. Dines.

Some one may ask, after all this clearing away of fallacies—What have we left? and I would venture to refer him to all the patient work which is being done in various countries, and by which a real science of meteorology is being slowly built up, while to the outdoor weather student I would offer this consoling reflection—There is still the sky.

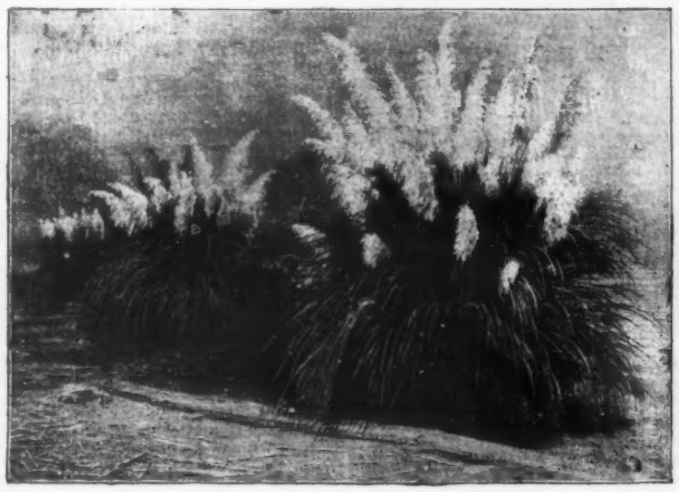
A LARGE VINE.

THE following details respecting a black Hamburg vine in the gardens at Hackthorn Hall may be of interest. The vine is twenty-five years old, and stands in the center of a house 54 feet long by 18 feet wide, which it completely covers. It springs from a single upright stem, the girth of which is 1 foot, and which sends out two horizontal branches in opposite directions. From these descend ten smaller branches, which follow the slope of the roof. The vine is always very clean and healthy, and is now bearing 300 bunches of well colored grapes. I should be interested to know if there are many larger vines in private gardens.—E. W. Cracroft, in the Gardeners' Chronicle.

THE CULTIVATION OF PAMPAS GRASS.

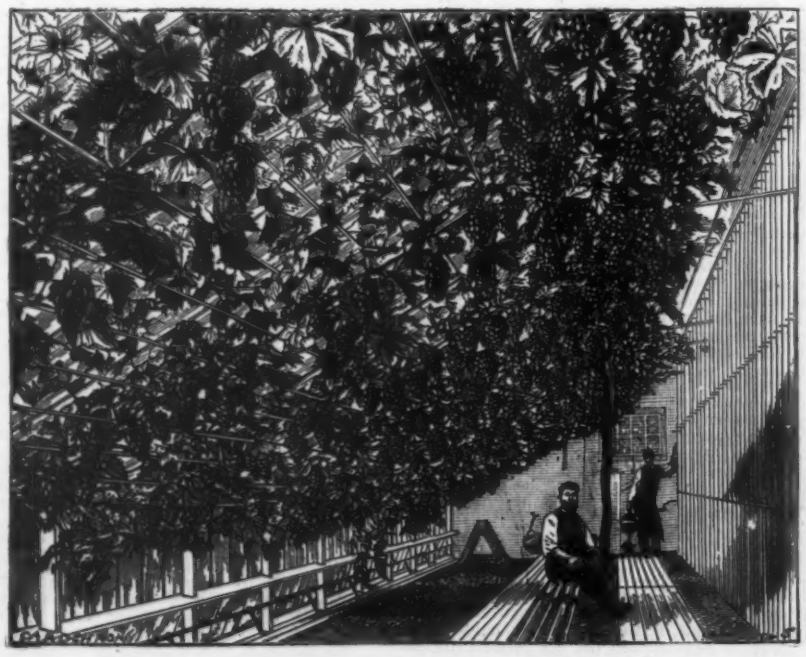
THE cultivation of pampas grass is one of the small but interesting industries of California—a country, according to the inhabitants, so glorious that they sell the climate and give the land in as a makeweight to the bargain. August and September are the months in which the crop of plumes is gathered for distribution over the Eastern States of America and for export to this country. Probably not much more than a hundred acres is devoted to this grass in the whole of California, but each plant bears some thirty or forty plumes, and there are about three hundred plants on an acre, so it is very evident that the total number of these ornaments grown is very large. One of the largest producers has twenty acres of pampas grass on a ranch two miles from the little Quaker town of Whittier. If there are no old plants, the seed is sown during the rainy season in January or February in rows twelve feet apart, and carefully tended until the feathery fronds have attained their glory. As soon as this happens the plumes, which often grow to a height of twelve or fourteen feet, are cut by hand and the green leaves stripped off. They are then laid out to

GRASS LAID OUT TO DRY.



THE GRASS IN FULL BLOOM.

THE CULTIVATION OF PAMPAS GRASS—SCENES ON A CALIFORNIAN FARM.



BLACK HAMBURG VINE, HACKTHORN HALL.

dry in the sun for three days to take the sap out of the stem, as is seen in our illustrations. After this they are collected and tied up into bundles of fifty, to be sent to the dealers. Five cents or 2½d. is a common price for a plume. Sometimes they are dyed red, violet, green or yellow before they go to the market.

The crop is very exhausting to the soil; so after a few years walnut trees are planted and the grass is cut out. The work of gathering the plumes is an easy one, and suits the Mexican laborers, who are chiefly employed.—Daily Graphic.

CAMPANULA VIDALI.

So few of the present generation of horticulturists are acquainted with this handsome bell flower, that the splendidly flowered specimens exhibited by J. T. Bennett-Poë, Esq., at the second of the two July meetings held by the Royal Horticultural Society created an immense amount of interest, and the majority of those under whose notice they came regarded them as representing a quite new species. The plants were so well grown and presented such an attractive appearance as to well merit the attention they received and the praise lavished upon them; but, as Mr. Poë was careful to point out, the species is not new. It was introduced to this country in 1851, and seed was distributed in that year by the late Mr. W. P. Ayres, who obtained his supplies from Mr. Wallace, of St. Ann's, Porta Delgado. The honor of discovering Campanula Vidali is due to Captain Vidal, who found it growing upon an insulated rock on the east coast of Flores, Azores. Figures were given in that year in the Botanical Magazine, and in Hooker's "Icones Plantarum;" but as these were evidently prepared from small shoots, they fail to convey other than a very imperfect idea of the great beauty of the plant when well developed, as in the case of Mr. Poë's specimens. These were grown in nine inch pots, had an average of six flowering spikes, many rising to a height of three feet, and bearing from twelve to twenty-five blooms each. The plant has a half shrubby habit, and the flowers are campanulate, about one and a half inches in length, and three-quarters of an inch in diameter across the widest part, and are pure white.

When first introduced it was suggested that possibly it would prove hardy in this country; but, as might have been expected by any one acquainted with Azorean vegetation, it is only half hardy and requires a greenhouse for its successful cultivation. Propagation can be effected from cuttings of the shoots that have not flowered and from seed. Raising seedlings has much to recommend it, as these usually make finer specimens than do plants raised from cuttings. The plants will, as a rule, bloom satisfactorily the second year, and with skillful cultivation will continue to increase in beauty until the fourth or fifth year, when they will show signs of having passed the meridian and should be replaced by young examples.

A first-class certificate was conferred upon C. Vidali by the Floral Committee of R. H. S. at the meeting mentioned, and it is to be hoped that the distinction, coupled with our illustrations, will induce cultivators generally to follow the admirable example of Mr. Poë, who is deserving of the heartiest commendations for having rescued this fine plant from the oblivion into which it had undeservedly fallen.—The Gardeners' Magazine.

CHERRIES.*

By L. H. BAILEY and G. H. POWELL.

THE sour cherry class includes two general types:

1. Amarelles (Latin for bitter), with pale red fruits, which are generally flattened on the ends, and an uncolored juice. Here belong the Montmorency, early Richmond, and their kin.

2. Morellos or Griottes, from the Italian, meaning blackish.

The sweet cherry group is represented in this country by four types:

1. Mazzards (Merisier of the French), small fruits of various shapes and colors, represented by miscellaneous and inferior seedlings of the sweet cherry species.

2. Hearts or Geans, French guigne—with a soft fleshed heart shape fruit, represented by the Governor Wood, Black Eagle, Black Tartarian and the like.

3. Bigarreaus, hard fleshed, or crackling cherries, mostly of light color and heart shape, comprising Windsor, Napoleon, Yellow Spanish and others.

4. Dukes differ from the heart cherries chiefly in having an acid or subacid fruit. Here belong the May Duke, Reine Hortense, Belle de Choisy and a few other sorts.

SOUR CHERRIES IN WESTERN NEW YORK.

The growing of sour cherries in western New York is largely confined to two varieties, the Montmorency and English Morello, and it is not yet fully determined which of the two is the more profitable in the long run. The preference has generally been given to the English Morello, as it bears younger than the other, and its dark colored and very acid flesh has made it popular with the canning factories. Just now, however, the canners are calling for the Montmorency in preference, for, while not so sour as the other in the natural state, it "cooks sour," and the Morello is apt to develop a bitterish or acid taste in the cans. The Morello is also much subject to leaf blight, while the Montmorency is almost free from it and the Montmorency is a stronger and more upright grower. The present drift is decidedly toward the Montmorency. The two varieties complement each other, however, for the Montmorency is about gone by the time the other is fit to pick.

This Montmorency of western New York is a very light red, long stemmed cherry, broad, and flattened on the ends, the flesh nearly colorless and only moderately sour. The tree is an upright, vase-like grower.

Early Richmond is the only other Amarelle, or white juiced cherry, which is grown to any extent in western New York, and this is not very valuable. Its flavor and quality are poor, the fruit is soft and small, and it is so early that it competes with the late strawberries. It is considerably used by canners, but the better cherries are bound to drive it out.

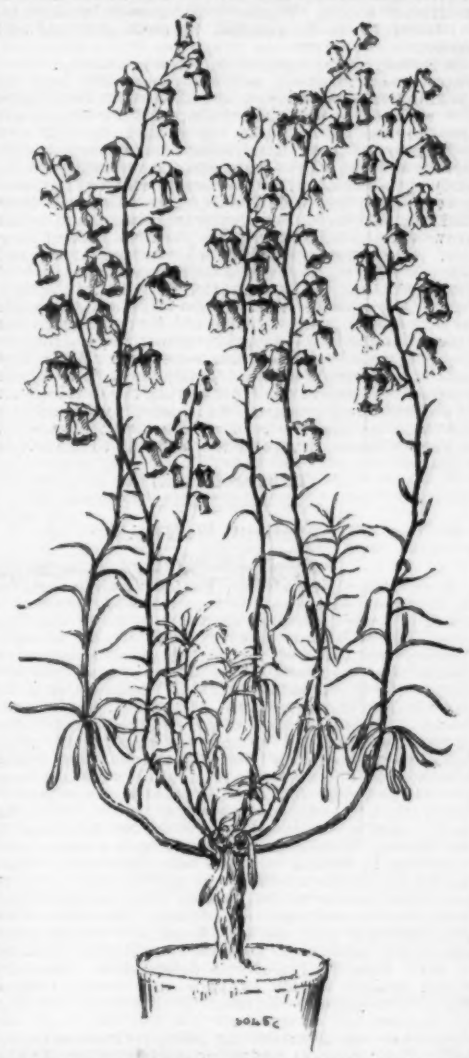
Among the Griottes, or red-juiced cherries, three have gained some notoriety in western New York—the Ostheim, Louis Philippe, and Morello.

The Ostheim is a very productive variety, ripening about a week after Early Richmond, but it is too small and too early to be valuable for general cultivation here. As compared with Early Richmond, it is darker red, rounder and somewhat smaller, the stem longer, stouter and straighter, flesh and juice dark red and less acid. Hangs long on the tree.

Louis Philippe is one of the best of all the sour cherries, and it would no doubt be generally grown were it not for the prevalent opinion that it is unproductive. C. W. Stuart, of Newark, who has had a long experience with this cherry, tells me that it is a profuse bearer when the tree has attained some age, and he thinks that it might be more freely planted with profit. It seems to be particularly attractive to the curculio, and some growers regard this as the cause of its unproductiveness.

The Morello, variously known as English, large, Dutch and Ronald's Morello, is nearly two weeks later than Montmorency, a bushy and finally a drooping grower, with medium sized, roundish or round cordate fruits which become red-black when fully ripe. Flesh very dark, much sourer than the Montmorency.

The Cherry Orchard.—A strong, loamy soil, and one which is retentive of moisture, is the most suitable for sour cherries. The fruit contains such a large amount of water that it is necessary to save the moisture of the soil to the greatest possible extent. Dry clay knolls produce cherries of less size and of inferior quality than the moister depressions between them. Very early and thorough cultivation is essential to this conservation of moisture, and the tillage should be continued at frequent intervals until the fruit is about ripe. In order to be able to cultivate the soil at the earliest moment in the spring, the land should be either naturally or artificially well drained. The crop of even the Morellos is off the trees in July, so that there is abundant opportunity to sow a catch crop on the orchard for a winter cover, if the manager so desires. A variety of plants may be used for this cover. The best is probably crimson clover, particularly if the orchard needs more nitrogen or growth; and if American grown seed is sown by the middle of August in a well prepared soil, the cover will probably pass the winter safely. Other plants which may be used for cover are rye, winter wheat, vetch, field pea, sowed corn, millet and buckwheat. Of these, only the first two will live through the winter and grow in the spring. In using cover crops which survive the winter, it is very important that they be turned under just as soon as the ground is dry enough in spring. As soon as the plant begins to grow it evaporates moisture and dries out the soil: and it is more important, as a rule, to save this moisture than it is to secure the extra herbage which would result from delay. This is especially true with the sour cherry, which matures its product so early in the season, and which profits so much by a liberal and constant supply of soil moisture. Plowing can also be begun earlier on land which has a sowed crop upon it, because of the drying action of the crop. The fertilizers which give best results with other orchard fruits may be expected to yield equally good returns with the cherry.



CAMPANULA VIDALI FULL-GROWN PLANT.

It is an almost universal fault to plant cherry trees too close together. The Montmorency should not be planted closer than 18 feet each way, in orchard blocks, although it is often set as close as 12 feet. The English Morello is a more bushy grower and may, perhaps, be set as close as 16 feet with success; but I believe that even this variety should stand 18 feet apart. The sour cherry orchards in western New York are yet so young that the evil effects of close planting have not yet been made apparent. I find, however, that nearly every shrewd orchardist who has had experience with these fruits is convinced that the general planting is too close.

Cherries are usually set when two years old from the bud. The sour varieties are propagated both upon Mazzard and Mahaleb stocks, chiefly the latter, but the comparative merits of the two are not determined. The tops are started about three or four feet high, and the subsequent pruning is very like that given the plum. If the young trees make a very strong growth and tend to become top heavy, heading in may be practiced; but this operation is not considered to be necessary after the trees begin to bear. Cherry trees require less attention to pruning than apple trees and peach trees do.

The English Morello will bear a fair crop the third year after setting, if two year trees are planted. The Montmorency is a year or two later in coming into bearing. The Montmorency, partly because of its larger growth, produces much more fruit than the other, when it arrives at full bearing. Individual trees of Montmorency at six years and upward may bear from 30 to 75 pounds of fruit; but Mr. Scoon considers 8 to 10 tons of marketable fruit to be an excellent crop on an orchard of 800 Montmorencys 8 years planted—that is, an average of 20 to 25 lb. to the tree. The Morellos, because of their dark color, usually sell better than the Montmorency in the open market, but the reverse is now generally true if the crop is sold to canning factories. This year the factories have paid five and six cents a pound for Montmorencys. It is easy to figure the proceeds of an acre. At 18 × 18 ft., an acre will comprise about 130 trees. If, at 8 years, they yield 20 pounds each, the crop would amount to 2,600 pounds, which at 5 cents means $130. This is a conservative estimate. Benjamin Kean, Seneca, has 200 Montmorency trees, 6 years set. He has had three crops, one of 1,400 pounds, one of 3,000 pounds, and 3,100 pounds. He sold his entire crop this year for 5 cents, making a gross income of $155. His trees are set 10 × 12 ft., which allows about 360 to the acre. In other words, a crop which sold for over one hundred and fifty dollars was taken from less than two-thirds of an acre. The soil, in this case, seems to be unusually well adapted to this cherry and the crops have, therefore, been excellent; but, on the other hand, part of the crop was destroyed this year by the curculio. C. H. Perkins, Newark, has 35 trees, 8 and 12 years old, all Montmorency. "They bear," he writes, "from 2,000 to 3,500 lb. of cherries per year and the average price we get for them is 6 cents. They net us from $100 to $175 a year. They are the most regular and sure cropper of any fruit we have ever tried to grow, and the fruit always finds a ready market at a good price." The Maxwell orchard at Geneva yielded over 11 tons, Montmorency, this year, from 800 trees.

My reader will now want to order enough cherry trees to plant his farm. But he should go slow. It may be laid down as a principle that no crop will bring uniformly great rewards over a series of years. These results with sour cherries are obtained only when all the conditions are present, such as the proper soil, excellent care and fertilizing, ability to secure pickers, and access to good markets. One could probably not rely upon the open market for the disposal of a very large planting of sour cherries. He should have access to one or more canning factories. It is a fact that more than half of all the orchards, of whatever kind, which are conceived in expectation and planted with enthusiasm, turn out to be profitless. The fault lies somewhere under the owner's hat. Persons who fail to grow other fruits with profit may also expect to fail with cherries. Yet I know of no fruit which, upon the testimony of both producers and consumers, offers a greater reward than sour cherries. The public seems to have acquired a taste for the canned product, and there is every indication that this demand will increase.

The labor of picking cherries, which is a bugbear to so many who would like to plant the fruit, is really no more onerous than the picking of raspberries or currants. If one lives where pickers cannot be had with certainty, and in sufficient numbers, cherries should not be planted. Parties who hire pickers by the piece pay three-fourths cent or a cent a pound. The trees must be gone over twice, at intervals, and generally three times, and it is important that all those fruits which are ripe, and no others, should be secured at each gathering. It is more difficult to see that this is done on cherry trees than on berry bushes, and for this reason some growers prefer to hire pickers by the day. When picking for canners, the fruit may be allowed to become much riper than when it is to be sold in the open market, and it is not necessary to exercise so much care to preserve the stems upon the fruits. The English Morello drops easily when ripe, and growers sometimes shake off the cherries—if designed for canning—onto sheets or, if the trees are small, into a Johnson curculio catcher. If cherries are carefully hand picked for the general market, the stems being left on, a pound of fruit measures about a quart and a quarter, but as the fruit is generally picked for canning, a pound is about a quart.

Insects and diseases are not serious upon the sour cherries. The curculio does not often attack the mid-season and late varieties—such as Montmorency and Morello—seriously, particularly if the number of trees is somewhat large. In occasional years, however, this insect becomes a scourge. The grower must watch his fruits closely after the blossoms fall, and if the curculio injuries become alarming, he must catch the insects by jarring them onto sheets. There are those who declare than they attract the curculio away from the cherries by planting plum trees in the cherry orchard, but I greatly doubt the efficiency of this procedure. A complete account of the curculio may be expected in a forthcoming bulletin.

The leaf blight or shot hole fungus (Cylindrosporium Padi, or Septoria cerasina, the same which attacks

* Abstracts from Bulletin 99, Cornell University Agricultural Experiment Station, Horticultural Division.

the plum) is often a serious enemy, particularly upon the English Morello. The leaves begin to assume a spotted character, generally before the fruit is picked, they soon turn yellow, and they fall prematurely. Thorough spraying with Bordeaux mixture is as efficient in holding the leaves on the cherry as it is on the plum. The trees should generally be sprayed twice between the falling of the blossoms and the coloring of the fruit. If the cherries are more than half grown when the last spray is applied, the ammoniacal carbonate of copper may be used in place of the Bordeaux, to avoid discoloring the fruit. But it is doubtful if the last spray should be delayed until this time. It may be necessary to spray once after the fruit is off.

A thin grayish powdery mildew (Podosphæra Oxyacanthæ) frequently attacks the fruits and leaves of the sour cherries, particularly when the trees are overshaded by larger trees or buildings. I have never known it to be serious upon the fruit, as it appears about the time the fruit is ripening, covering the cherries with a very delicate coat, like dust. In this case a late spraying with ammoniacal carbonate of copper would certainly be effective. The only emphatic injury which I have ever seen from this fungus upon cherries occurs after the fruit is off, when it may attack the ends of the shoots, checking the growth. At this time, if the injury threatens to be serious, Bordeaux mixture may be used.

THE SWEET CHERRY INDUSTRY.

Unlike most other fruits, the sweet cherry has never attained a prominent position as a horticultural industry in western New York. There is not a single orchard of it west of Albany, so far as I know. Along the Hudson, however, there are three or four orchards. It is from the few trees scattered on every farm throughout the State that the cherry crop is mostly harvested. It should not be concluded, however, that the smallness of the industry follows from a lack of appreciation on the part of New York people of this most luscious fruit. It is due to the fact that the cherry is one of the most difficult crops to handle and market successfully, because of its exceedingly delicate character and its susceptibility to the fungus, which causes the brown rot. This fungus spreads so rapidly on the ripening fruit that a promising crop today may be half rotted to-morrow. The comparative ease of handling and marketing a grape, an apple or a pear crop have made those fruits universally popular, while the cherry has lain in obscurity.

The cherry is one of the most popular dooryard fruits, and its hardiness, its vigorous spreading or ascending branches, its upright form, which often attains the height of 40 to 50 feet, and its luxuriant, soft, drooping foliage make it a most desirable tree for ornamental and fruit bearing purposes. Among the strongest recommendations of the cherry are its hardiness and the fact that it bears annually when properly treated. The trees begin to grow very early in the season and the fruit of most varieties is harvested by July 1, thus leaving the tree sufficient time and energy to perfect the fruit buds for the coming year; and if the wood ripens during the fall the mercury can fall to 20° below zero without injury to the coming crop. There seems to be a general inquiry among fruit growers and farmers concerning the care of cherry orchards, the most desirable varieties, the diseases and methods of handling and marketing a crop. As these matters are more fully understood, the cherry industry may be expected to reach a prominent position among the other horticultural industries.

Soil and Location.—The cherry tree is a gross feeder and grows with surprising rapidity, the limbs of young trees sometimes increasing from four to six feet in one season. This characteristic of the cherry must not be lost sight of in selecting a site for the cherry orchard, for when too rapid growth takes place the trunks and large limbs split open, the sap exudes abundantly, little or no fruit is borne, and the life of the tree is short. The cherry will grow in a variety of soils, even where other fruit trees will not thrive, but the ideal soil is a naturally dry, warm, mellow, deep gravelly or sandy loam, of good quality, containing sufficient humus to retain moisture and give lightness, but not enough to make the soil damp and heavy. If the soil is not naturally dry, it must be well drained, for dryness is essential to success with the vigorous growing sweet cherries. While more orchards are unproductive from a lack of plant food than from an excess, it is well to remember that the vigorous growing habit of the cherry lays it open to severe injury and unfruitfulness if the soil is too rich.

The ideal situation for the orchard is a high altitude, which insures good atmospheric as well as land drainage and lessens the dangers from late frosts in the spring and from the rot. The cherry is an early bloomer, and it should be placed where the cold air at night will settle away from it, as injuries from spring frost frequently occur.

Distance of Trees.—Since the cherry attains a large size, the limbs spreading twenty feet or more and the roots reaching a long distance, it must be given plenty of room, and I am convinced that thirty feet each way is the proper distance to set sweet cherries. I have seen trees twenty-two feet apart with their main branches interlacing, and the trees were allowed to assume a pyramidal form instead of a spreading habit. At thirty feet each way an acre contains fifty trees.

Pruning.—The cherry orchard will require little pruning after the first two or three years, and before that time the tree can be made to assume any desired form. I believe, however, that in general the pruning should be such as to give the tree a low spreading head, with a trunk about four feet high and with the top built out on three to five main arms. We have pursued this method on the Windsor and other varieties, and the trees, instead of growing in the usual spire shape, assume an apple tree form. After the first two or three years no pruning is needed, except to remove dead branches and to keep superfluous branches from intercrossing.

The advantages gained from this form of tree are of great importance. First the body of the cherry tree is less likely to be injured from the hot sun, which causes it, especially on the side of the prevailing wind, to crack and split, exude sap and finally to die. The low spreading head shades the trunk and large branches and obviates this difficulty to a great extent. In western New York this trouble is not so serious as it is on the black lands farther west. A second advantage, of equal or greater importance, lies in the fact that, if allowed to grow upright, the limbs reach the height of 30 to 40 feet in twenty-five years, making it very difficult to gather the fruit and to spray the trees. The bearing branches are always found toward the extremities of the limbs, and the time which men lose in going up and down long ladders is of no small account to the fruit grower.

Cultivation.—A young cherry orchard should be given clean cultivation. Small fruits, like currants, raspberries or gooseberries or any others that require frequent cultivation, may be set between the rows for 8 or 10 years, but the bushes should be removed in the tree rows and opposite the trees at the end of the third year. No crop that does not require cultivation should ever be raised in the orchard. In general, the methods described in Bulletin 72 upon "The Cultivation of Orchards" should be followed.

At about five years old the trees begin to bear fruit of consequence, and at ten years they give paying crops. As the orchard comes into bearing, the management of the soil will differ according to its nature, and the trees themselves should be the indicators of their treatment. Though there have been no experiments in the treatment of bearing cherry orchards, I believe that clean culture should generally be stopped by June 15 or July 1, so as to check growth and give the wood sufficient time to ripen. The advantages of this treatment are also pointed out in the Bulletin mentioned above. Whenever the growth becomes too luxuriant, it can be checked by seeding a year with clover.

A certain cherry orchard has stood in sod for fifteen years in an ideal soil and situation. The trees are making little growth and are filled with dead limbs, and while there was a heavy crop of cherries this year, the size was small, quality poor, and one-half were rotting on the trees. In striking contrast was a neighboring orchard which had been plowed lightly in the early spring and had had a harrow run over it once a week up to the middle of June, and although there had been a severe drought, the trees had made a good growth and were loaded with luscious fruit of large size. The latter orchardist believes that he can produce as large cherries as the Californians can, by high cultivation and the conservation of moisture the early part of the season. As a means of holding moisture, he is putting humus in the soil by cover crops and expects to check too luxuriant growth by seeding the orchard whenever it becomes necessary. While dryness is a universal maxim for the cherry, it is advantageous to conserve moisture during the development of the fruit, and the example furnished by this orchard convinces me that the fruit can be increased one-half in size by thorough light cultivation up to the middle of June.

(To be continued.)

BURMESE WOMEN.

By H. FIELDING.

NOWHERE under the sun has any nation accorded to its women such absolute freedom, such entire command of their lives and property, as have the Burmese. They stand in every way on an absolute equality with men, as far as law, as religion, and as custom are concerned. Just as no conquest has ever obliged the Burmese to resort to feudalism, so it has never caused the seclusion of the women, nor been the reason of one-sided laws of inheritance. In the face of the law, man and woman are alike. Girls share equally with boys in all inheritance, and they inherit absolutely. There are no trustees between a woman and her property, and when she marries she retains it. Her husband has no control over it at all, neither has he any legal control over her. From her childhood up she is free. Parentage has never been another form of slavery in Burma, as it has been elsewhere. Children are not so much ordered as guided and cared for, and when comparatively young they are practically given control over their own doings. Not without advice carefully and usefully given, not without every precaution against ill that care can devise, but there is little command and no compulsion. Chivalry, which praised women as gods and treated them as slaves, never came to Burma. No Burman lover sings his mistress as something too good for this world, and then treats her as something infinitely inferior to himself. Their religion has never considered them as the source of all evil, has never warned man against them as snares to lead men to hell, and no pope has ever called them the "sole hope of the church." There has been no second rate literature to give them false ideals of themselves, of man, and of the world. They have always been held for what they are, and they have had freedom to find their own place in a very real world, unfettered by conventions and rules. They have always had fair play, both from men and from themselves, and they have been held the best judges of what will soil them. No artificial ideals from long past ages have been held up to them as eternal copies; it has been left to their own good sense and to the eternal fitness of things to determine what is womanly and what is not. Thus they have found what under the varying circumstances of life is the best life for them, and as circumstances change so will they. Of all women in the world none are more womanly than she is, none possess in greater strength all the nameless attraction of a woman. She is no Helen, she is no Aspasia, least of all is she an Amazon; but to those who know her she is everything that is lovely and desirable in womanhood. And when I say that Burmese women are not beautiful, it must not be supposed that they are ugly. Beauty in women is a matter of convention. What was beautiful two hundred years ago in England is not beautiful to-day. So newcomers to Burma wonder at those who speak of charm in a woman who has a fair sized waist, a small bust, and who wears a loose jacket. Nevertheless, it is there, and no one who knows them fails to discover it; but no one can describe it. It is the light within that shines through every look and gesture, and illumines their whole life. Their complexion is fairer than that of the men, and they have large brown eyes—those restful eyes that men love. Their manners are quiet and self-restrained, never self-conscious, rarely coquettish, and their voices are soft and sweet.

They are not so universally educated to read and write as are the boys, because they cannot go to the monastery schools, where all the boys are taught. Yet, nevertheless, nearly all the women of the class above the peasants can read and write, and many of the latter can, too.

And they have no accomplishments. They do not play any instrument, they are not taught to sing, though many sing ballads correctly and naturally. Of dancing, of sketching, of the use of the globes, they know nothing at all. But of all household matters they are thoroughly acquainted. They can all weave and cook and sew, and some can embroider. And they understand the life around them. Nothing is more surprising than to find how well even the young girls know the men and women that they meet, how clearly their sweet eyes see the world about them. The opinions and thoughts of a girl are always worth hearing, for they are founded on what she sees, they are no dreams of a night of ignorance, they are beautiful as only the thoughts that come from knowledge can be.

Burmese boys are at an early age formally admitted to Buddhism, in a ceremony that takes place at the beginning of Lent. They are made inmates of the monastery, perhaps for three months, perhaps for a day only, but they are always admitted. But with girls it is not so.

Neither do they ever become nuns. Old women sometimes take the vows; but it is the last thing a Burmese girl would ever think of. Probably the absence of any leisured class is the principal cause of this. The amusements of a girl are not very many. There are the pwès to which she may go, where she will hear plays of all kinds, and there are boat races and festivals of different sorts during the dry weather, and she will have many friends to see and talk to, but of games they have none. In every household the daughter has her appointed work. In all but the richer merchants' houses the daughter's duty is to bring the water from the well evening and morning. It is the gossiping place of the village, this well, and as the sun sets there come running down all the girls of the village. As they fill their jars they lean over the curb and talk, and it is here that is told the latest news, the latest flirtation, the latest marriage, the little scandal of the place. Very few men come. Water carrying is not their duty, and there is a proper time and place for flirtation. So the girls have the well almost to themselves. Almost every girl will weave. In every house there will be a loom, where the girls weave their dresses and those of their parents. And very many girls will have stalls in the bazar, but of this I will speak later. Other duties are the husking of the rice and the making of cheroots. Of course, in the richer households there will be servants to do all this; but even in them the daughter will frequently weave, either for herself or for her parents. Almost every girl will do something, if it be only to pass the time.

They do not marry very young. From sixteen to twenty is the usual age, but it is often later. It entirely depends on the girl herself. It is in her own hands whom she marry and when. There is a delightful custom all through Burma, an institution in fact, called "courting time." It is from nine till ten o'clock, more especially on moonlight nights, those wonderful tropic nights, when the whole world lies in a silver dream—when the little wandering airs that touch your cheek like a caress are heavy with the scent of flowers, and your heart comes into your throat for the very beauty of life. There is in front of each house a veranda, perhaps three feet above the ground, and here the girl will sit in the shadow of the eaves, sometimes with a friend, but usually alone, and her suitors will come and stand by the veranda and talk softly, in little broken sentences, as lovers do. There may be many young men come, one by one if they mean business, with a friend if the visit be merely one of courtesy. And the girl will receive them all, and she may give them cheroots; and if a very favored suitor come, she may even light his cheroot for him, and thus kiss by proxy.

And is the girl alone? Well, yes! To all intents and purposes she is alone; but there is always some one within call in the house, for no one can tell who may come to the veranda, and some men, we know, are but wolves in sheep's clothing. But the girl carries on her lovemaking herself, and she is free to marry whom she will. No one will object, provided only he be of good reputation, and able, with such assistance as she can give, to maintain the household. And if there should be any difficulty? Well, then there is usually an elopement, and a ten days' scandal. And often, too, there is an elopment for no reason at all, save that hot youth cannot abide the necessary delays.

For life is short, and though to-day be to us, who can tell for the morrow? During the full moon there is no night, only a change to silver light from golden. And the forest is full of delight. There are woodcutters' huts in the ravines where the water falls, soft beds of torn bracken and fragrant grasses, where great trees make a shelter from the sun. And for food, that is easily arranged. A basket of rice, with a little salt fish and spices, is easily hidden in a favorable place. You only want a jar to cook it, and there is enough for two for a week. Or it is brought day by day by some trusted friend to a place previously agreed on.

All up and down the forest there are flowers for her hair, scarlet dak blossoms, and pale orchid sprays, and jasmine stars. And for occupation through the hours each has a new world to explore, full of wonderful undreamed of discoveries, lit with new lights and mysterious with roseate shadows, a world of "beautiful things made new" for those forest children. So that when the confidant, an aunt, may be, or a'sister, meets them by the sacred fig tree on the hill and tells that all difficulties are removed, and their friends called together for the marriage ceremony, can you wonder that it is not without regret that they fare forth from that enchanted land to ordinary life again?

It is not always the man who is the proposer of the flight.

I had a Burmese servant, a boy who may have been twenty, and he had been with me about a year, and was beginning to be really useful. He had at last grasped the idea that electroplate should not be

cleaned with monkey brand soap, and he could be trusted not to put up rifle cartridges for use with a 20 bore gun. And he chose his time to fall in love with the daughter of the headman of a certain village where I was in camp.

He had good excuse, for she was a delicious little maiden, with great coils of hair, and the voice of a wood pigeon wooing in the forest, and she was very fond of him without a doubt. So one evening he came to me and said that he must leave me—that he wanted to get married, and could not possibly delay.

Then I spoke to him with all that depth of wisdom we are so ready to display for the benefit of others. I pointed out to him that he was much too young, that she was much too young also—she was not eighteen—and that there was absolutely nothing for them to marry on. I further pointed out how ungrateful he would be to leave me; that he had been paid regularly for a year, and that now, when he was at last able to do something besides destroy my property, he was about to go away.

The boy listened to all I had to say, and agreed with it all, and made the most fervent and sincere promises to be wise, and he went away after dinner to see her and tell her, and when I awoke next morning my servants told me the boy had never returned.

Shortly afterward the headman came to say that his daughter had also disappeared. They had fled, these two, into the forest, and for a week we heard nothing. At last, one evening, as I sat under the great fig tree before my tent, there came to me the mother of the girl, and sat down before me, and said she had something of great importance to impart; and this was that all had been arranged between the families, who had found work for the boy whereby he could maintain himself and his wife, and that the marriage was arranged. But the boy would not return as long as I was in camp there, for he was bitterly ashamed of his broken vows, and afraid to meet my anger. And so the mother begged me to go away as soon as I could, so that the young people might return. I explained that I was not angry at all, that the boy could return without any fear of my wrath; on the contrary, that I should be pleased to see him and his wife. And at the old lady's request I wrote a Burmese note to that effect, and she went away delighted.

They must have been in hiding close by, for it was early next morning that the boy came into my tent alone and very much abashed, and it was some little time before he recovered himself, and began to talk freely as he would before, for he was greatly ashamed of himself.

But, after all, could he help it?

If you can imagine the tropic night, and the boy full of high resolve passing up the village street, now half asleep, and the girl with shining eyes coming to him out of the hibiscus shadows, and whispering in his ear words—words that I need not say; if you can imagine all this, you will understand how it was that I lost my servant.

They both came to see me later on in the day, after the marriage, and there was no bashfulness about either of them then. They came hand in hand, with the girl's father and mother, and some friends, and she told me it was all her fault. She could not wait. "Perhaps," she said, with a little laugh and a side glance at her husband—"perhaps if he had gone down with the thakin to Rangoon, he might have fallen in love with some one there, and forgotten me. For I know that they are very pretty, those Rangoon ladies, and of better manners than I, who am but a jungle girl." And when I asked her what it was like in the forest, she said it was the most beautiful place in all the world.

Sometimes things do not go so well. Suicide for love! We read of it in fiction, do we ever see it? Not in England I think, but I have seen it once and again in Burma. I have held an inquest over the fair innocent body of a girl not seventeen who drowned herself for love. Only that. He never had cared for her, he never would, for he was in love elsewhere. And so one morning, ere the mist had risen from the water, she gave herself and her hot despair to the cool forgetfulness of the great river.

And I have seen a girl in man's attire killed in a surprise attack upon an insurgent camp. She had followed her outlawed lover there, and in the mêlée she caught up sword and gun to fight by his side, and was cut down through neck and shoulder; for no one could see in the early dawn that it was a girl. She died about an hour afterward; and, though I have seen many sorrowful things in many lands, in war and out of it, the memory of that dying girl, held up by one of the mounted police, sobbing out her life beneath the wild forest shadows, with no one of her sex, no one of her kin, to help her, comes back to me as one of the saddest and strangest.

Her lover was killed in action some time later fighting against us, and he died, as a brave man should, the best of all deaths. He played his game; he lost and he paid; but the girl?

Marriage is not a religious ceremony among the Burmese. There is a ceremony, of course, but the only necessary and binding part of it is that the couple should, in the presence of witnesses called together for the purpose, eat out of the same bowl.

A girl does not change her name. Family names are unknown, and there is no Miss or Mrs. Every woman, married or unmarried, has the prefix of Ma or Mi, which are the same word. Even as babies they carry this prefix, and marriage does not alter it, so that there is nothing to denote whether a woman be married or not. Marriage does not alter her status in any way. She retains her own property, and any property she may acquire subsequently is also her own. Property acquired jointly with her husband is held jointly. If you inquire who is the owner of a garden, you may be told it belongs to Maung Han Ma Ni, the former being the man's name and the second that of his wife, and both names are used frequently in business and legal proceedings. But it is not always that a man and his wife are in the same business. They may have totally different pursuits. One may be a cultivator, the other a silk dealer; the man may be a pleader in court, the wife may own brick kilns outside the town.

Of course, there are cases where marriage necessitates the abandonment by the woman of her trade, whatever it may be; but she can do as she thinks best. There was a friend of mine—a Burmese girl—perhaps she was twenty-five, and she kept a dainty little silkstall near the gate of a certain great bazar. She was the daughter of a well-to-do rice merchant, and she kept the stall for her own amusement and profit. This profit must have been considerable, and as she lived with her parents and had few expenses, she was well off. She was very pleasant to talk to, as one passed the bazar returning from office, or smoked a cigarette with her in the evening in her father's veranda. She was a graceful, charming girl, and she had had many lovers; but she had not cared for any of them, and it seemed to me as if she never would marry. Yet one day she surprised everyone by marrying a sergeant of police, whose pay could not have been a quarter what she made with her silk stall.

I had a long talk with her shortly before the marriage, and I asked her what she intended to do with her silkstall, for her husband was stationed in a guard some thirty miles away, so she could not both marry and keep on her stall, and she told me she would give it up. She had hoped her husband would leave the police and settle down and live with her on the profits of her stall, but he had refused.

"So," I said, "there will be only his pay, which is small?"

"Yes," she said, "that is all; but"—with a little smile—"what does it matter? There is enough." And that she would make it enough I have no doubt.

In married life, as in all other, there are certain duties that come naturally to the wife and certain others to the husband. He may be a magistrate, a pleader, or a rich merchant, in which case the wife, beyond managing her own property, does not work. Her duty is to superintend the housework, and, as in all lands, to make her home a place of rest and of content to her husband after his day's work. She will very likely accompany her husband on his journeys; she will assist him socially in what way she can; and, if it be necessary, she will act for him with vigor and decision. And as regards acting for her husband, there is nothing more remarkable than the division she makes of matters wherein she can act for herself, and of matters wherein, if she act, she acts for him. Thus, as I have said, she will, as regards her own property, or her own business, act entirely on her own responsibility, and in her own name. But in public affairs she will never allow her name to appear. Not that she does not take a keen interest in all such matters. She lives in no world apart: all that affects her husband interests her as keenly as it does him. She lives in a world of men and women, and her knowledge of public affairs, and her desire and power of influencing them, is great. But she learned long ago that her best way is to act through and by her husband, and that his strength and his name are her bucklers in the fight. Thus women are never openly concerned in any political matters. How strong this feeling is, can be better illustrated by a story than any other way.

In 1889 I was stationed far away on the northwest frontier of Burma, in charge of some four thousand square miles of territory which had been nearly incorporated. I went up there with the first column that ever penetrated that country, and I remained in charge when, after the partial pacification of the district, the main body of troops left. It was a fairly exciting place to live in. To say nothing of the fever, which swept down men in batches, and the trans-frontier people, who were always peeping over to watch a good opportunity for a raid, my own charge simply swarmed with armed men, who seemed to rise out of the very ground—so hard was it to follow their movements—attack anywhere they saw fit, and disappear as suddenly. There was, of course, a considerable force of troops and police to suppress these insurgents; but the whole country was so roadless, so unexplored, such a tangled labyrinth of hill and forest, dotted with sparse villages, that it was often quite impossible to trace the bands who committed these attacks, and to the sick and weary pursuers it sometimes seemed as if we should never restore peace to the country.

The villages were arranged in groups, and over each group there was a headman with certain powers and certain duties, the principal of the latter being to keep his people quiet, and if possible protect them from insurgents.

Now it happened that among these headmen was one named Saw Ka, who had been a free lance in his day, but whose services were now enlisted on the side of order—or at least we hoped so. He was a fighting man, rather fond of that sort of exercise, so that I was not very much surprised one day when I got a letter from him to say that his villagers had pursued and arrested, after a fight, a number of armed robbers, who had tried to lift some of the village cattle. The letter came to me when I was in my court house, a tent ten feet by eight, trying a case; so saying I would see Saw Ka's people later, and giving orders for the prisoners to be put in the lock-up, I went on with my work. When my case was finished, I happened to notice that among those sitting and waiting without my tent door was Saw Ka himself; so I sent to call him in, and I complimented him upon his success. "It shall be reported," I said, "to the commissioner, who will no doubt reward you for your care and diligence in the public service."

As I talked I noticed that the man seemed rather bewildered, and when I had finished he said that he really did not understand. He was aware, he added modestly, that he was a diligent headman, always active in good deeds, and a terror to dacoits and other evildoers; but as to these particular robbers and this fighting he was a little puzzled.

I was considerably surprised, naturally, and I took from the table the Burmese letter describing the affair. It began, "Your honor, I, Maung Saw Ka, headman," etc., and was in the usual style. I handed it to Saw Ka, and told him to read it. As he read his wicked black eyes twinkled, and when he had finished he said he had not been home for a week. "I came in from a visit to the river," he said, "where I have gathered for your honor some private information. I had not been five minutes here before I was called in. All this the letter speaks of is news to me, and must have happened while I was away."

"Then, who wrote the letter?" I asked.

"Ah!" he said, "I think I know, but I will go and make sure." Then Saw Ka went to find the guard who had come in with the prisoners, and I dissolved court and went out shooting. After dinner, as we sat round a great bonfire before the mess, for the nights were cold, Saw Ka and his brother came to me, and they sat down beside the fire and told me all about it.

It appeared that three days after Saw Ka left his village some robbers came suddenly one evening to a small hamlet some two miles away, and looted from there all the cattle, thirty or forty head, and went off with them. The frightened owners came in to tell the headman about it, and in his absence they told his wife. And she, by virtue of the order of appointment as headman, which was in her hands, ordered the villagers to turn out and follow the dacoits. She issued such government arms as she had in the house, and the villagers went and pursued the dacoits by the cattle tracks, and next day they overtook them, and there was a fight. When the villagers returned with the cattle and the thieves, she had the letter written to me, and the prisoners were sent in, under her husband's brother, with an escort. Everything was done as well and as successfully as if Saw Ka himself had been present. But if it had not been for the accident of Saw Ka's sudden appearance, I should probably never have known that this exploit was due to the wife. For she was acting for her husband, and she would not have been pleased that her name should appear. "A good wife!" I said to Saw Ka. "Like many," he answered.

But in her own line she has no objection to publicity. I have said that nearly all women work, and that is so. Married or unmarried, from the age of sixteen or seventeen, almost every woman has some occupation besides her home duties. In the higher classes she will have property of her own to manage, in the lower classes she will have some trade. I cannot find that in Burma there have ever been certain occupations told off for women in which they may work, and others tabooed to them. As there is no caste for the men, so there is none for the women. They have been free to try their hands at anything they thought they could excel in, without any fear of public opinion. But nevertheless, as is inevitable, it has been found that there are certain trades in which women can compete successfully with men, and certain others in which they cannot. And these are not quite the same as in the West. We usually consider sewing to be a feminine occupation. In Burma, there being no elaborately cut and trimmed garments, the amount of sewing done is small, but that is usually done by men. Women often own and use small hand machines, but the treadles are always used by men only.

Weaving is usually done by women. Under nearly every house there will be a loom, where the wife or daughter weaves for herself or for sale. But many men weave also, and the finest silks are all woven by men. I once asked a woman why they did not weave the best silks, instead of leaving them all to the men. "They do them better," she said, with a laugh; "I tried once, but I cannot manage that embroidery." Rice husking, again, is a work that the women always do, and among the peasants the planting of the rice in the fields is always women's work. The field is plowed by the men with buffaloes or cattle into a wet slush, and the young rice plants are dug from the nurseries and brought down to the field, where they are distributed in bundles. Then the women form in line and plant the seedlings. It is not very difficult, as the plants are just pressed into the mud about five inches apart; and as the workers usually sing choruses while they work, it would seem to be pleasant toil.

But the great occupation of women is petty trading. I have already said that there are no large merchants among the Burmese. Nearly all the retail trade is small, most of it is very small, indeed, and practically the whole of it is in the hands of the women.

This trade is almost exclusively done in bazars. In every town there is a bazar from six till ten each morning. When there is no town near, the bazar will be held on one day at one village and on another at a neighboring one. It depends on the density of population, the means of communication and other matters. But a bazar within reach there must always be, for it is only there that most articles can be bought. The bazar is usually held in a public building erected for the purpose, and this may vary from a great market built of brick and iron to a small thatched shed. Sometimes, indeed, there is no building at all, merely a space of beaten ground.

The great bazar in Mandalay is one of the sights of the city. The building in which it is held is the property of the municipality, but is leased out. It is a series of enormous sheds, with iron roofs and beaten earth floor. Each trade has a shed or sheds to itself. There is a place for rice sellers, for butchers, for vegetable sellers, for the vendors of silks, of cottons, of sugar and spices, of firewood, of jars, of fish. The butchers are all natives of India. No Burman would trade in flesh, because he is forbidden to take life, and if he were not forbidden, he would not like to do so. The only exception to this is with regard to fish. Burmans catch fish, but it is not considered a very reputable profession. The firewood sellers will mostly be men, as will also be the large rice merchants, but nearly all the rest are women.

You will find the sellers of spices, fruit, vegetables and other such matters seated in long rows on mats placed upon the ground. Each will have a square of space allotted, perhaps six feet square, and there she will sit with her merchandise in a basket or baskets before her. For each square they will pay the lessee a halfpenny for the day, which is only three hours or so. The time to go is in the morning from six till eight, for that is the busy time. Later on all the stalls but the cloth and a few other stalls will be closed, but in the early morning the market is thronged. Every householder is then buying his or her provisions for the day, and the people crowd in thousands round the sellers. Every one is bargaining and chaffing and laughing, both buyers and sellers; but both are very keen, too, on business.

The cloth and silk sellers, the large rice merchants and a few other trades cannot carry on business sitting on a mat, nor can they carry their wares to and fro every day in a basket. For such there are separate buildings or separate aisles, with wooden stalls, on

either side a gangway. The wooden floor of the stalls is raised two to three feet, so that the buyer, standing on the ground, is about on a level with the seller sitting in the stall. The stall will be about eight feet by ten, and each has at the back a strong lock-up cupboard or wardrobe, where the wares are shut at night; but in the day they will be taken out and arranged daintily about the girl seller. Home-made silks are the staple—silks in checks of pink and white, of yellow and orange, of indigo and dark red. Some are embroidered in silk, in silver or in gold; some are plain; all are thick and rich, none are glazed, and none are gaudy. There will also be silks from Bankok, which are of two colors—purple shot with red and orange shot with red—both very beautiful. All the silks are woven the size of the dress—for men, about twenty-eight feet long and twenty inches broad; and for women, about five feet long and much broader. Thus there is no cutting off the piece. The anas, too, which are the bottom pieces for a woman's dress, are woven the proper size. There will probably, too, be piles of snowy cambric jackets and gauzy silk handkerchiefs; but often these are sold at separate stalls.

But prettier than the silks are the sellers—for these are nearly all girls and women, sweet and fresh in their white jackets, with flowers in their hair. And they are all delighted to talk to you and show you their goods, even if you do not buy; and they will take a compliment sedately as a girl should, and they will probably charge you an extra rupee for it when you come to pay for your purchases. So it is never wise for a man, unless he have a heart of stone, to go marketing for silks. He should always ask a lady friend to go with him and do the bargaining, and he will lose no courtesy thereby—for these women know how to be courteous to fellow-women as well as to fellow-men.

And in the provincial bazars it is much the same. There may be a few traveling merchants from Rangoon or Mandalay, most of whom are men; but nearly all the retailers are women. Indeed, speaking broadly, it may be said that the retail trade of the country is in the hands of the women, and they nearly all trade on their own account. Just as the men farm their own land, the women own their businesses. They are not saleswomen for others, but traders on their own account, and, with the exception of the silk and cloth branches of the trade, it does not interfere with home life.

The bazar lasts but three hours, and a woman has ample time for her home duties when her daily visit to the bazar is over. She is never kept away all day in shops and factories. Her home life is always the center of her life: she could not neglect it for any other; it would seem to her a losing of the greater in the less. But the effect of this custom of nearly every woman having a little business of her own has a great influence on her life. It broadens her views, it teaches her things she could not learn in the narrow circle of home duties; it gives her that tolerance and understanding which so forcibly strikes every one who knows her. It teaches her to know her own strength and weakness, and how to make the best of each. Above all, by showing her the real life about her, and how much beauty there is everywhere to those whose eyes are not shut by conventions, it saves her from that dreary, weary pessimism that seeks its relief in fancied idealism, in art, in literature and in religion, which is the curse of so many of her sisters in other lands.

Divorce in Burma is free. It can be claimed by either party for any good reason, such as incompatibility of temper, and carries no slur with it. No lawsuit is required. They go to the village elders, in a town to the elders of the quarter, and a divorce paper is drawn up that defines all arrangements as to property and children.

The law as to property is this: Each retains his or her own property, and all property acquired jointly during married life, as by trading, is divided equally. But the claimant of the divorce must leave the house and all the household goods to the other. If it be the woman, she may remove her loom; if it be the man, he may take nothing. Thus there is a certain penalty on claiming a divorce, but it is not a large one.

With this great facility for divorce it is remarkable how uncommon it is. I do not know the proportion, for as far as I am aware no statistics have ever been compiled either of marriages or divorces. As neither are concerned either with the courts or with religion, it would be difficult to get any reliable figures. But from my own observation I should say that one per cent. would be over the mark, and of this probably a third remarry, separation causing a renewal of the affection constant intercourse had dulled. These facts speak for themselves as to the happiness of the generality of marriages. Of the children in a divorce, the man takes the boys and the wife the girls; but I remember no case where a couple with children were divorced. And it is not alone to men of their own race that Burmese women make good wives. They are sought by all the many peoples that come there, by Englishman and Chinaman, by Mussulman and Hindoo, and to all alike they bring happiness in their married life.—Blackwood's Magazine.

INCUBATION AMONG THE EGYPTIANS.

ARTIFICIAL incubation, like many another practice supposed to be peculiar to modern civilization, is but a revival from very ancient times. Diodorus, an author who wrote about forty years before the commencement of the Christian era, tells how the Egyptians of his time, with their own hands, bring eggs to maturity, and how the young chickens thus produced are not inferior in any way to those hatched by the usual means.

The practice, probably with methods differing little from those of ancient times, survives to the present day among the fellahs of Egypt. In suitable places ovens are erected, and the proprietors go round the neighboring villages collecting eggs. A sufficient number having been collected, they are placed on mats strewed with bran, in a room about 11 feet square, with a flat roof. Over this chamber, which is about 4 feet high, there is another built about 9 feet in height. The roof, which is vaulted, has a small aperture in the center to admit light during the warm weather; below it another opening of larger dimensions communicates with the oven below. In the cold weather both are kept closed, and a lamp is kept burning within. Entrance is then obtained from the front of the lower chamber. In the upper room fires are made in troughs along the sides, and the eggs are placed on the mats below in two lines, corresponding to and immediately below the fires. The fires are lighted twice a day, the first time to die about midday, the second to last from about 3 p. m. to 8 p. m. The first batch of eggs are left for about half a day in the warmest situation, after which they are moved to make room for others, until the whole number in hand have had the benefit of the position. This is repeated for six days. Each egg is then examined by a strong light. All eggs that at this stage are clear are rejected, but those that are cloudy or opaque are restored to the oven for another four days. Then they are removed to another chamber, where there are no fires, but the air is excluded. Here they lie for five days, after which they are placed separately, about one or two inches apart, and continually turned. This last stage generally takes six or seven days. During this time a constant examination is made by placing each egg to the upper eyelid, when a warmth greater than that of the human skin is a favorable sign.

The duration of the process generally extends over twenty-one days, but thin shelled eggs often take only eighteen days. The average heat required is 86° F. Excessive heat is prejudicial. In Egypt the best time is from February 23 to April 24.—J. Tyrrell Baylee, in Nature.

HERBERT SPENCER ON THE NOMENCLATURE OF COLORS.

IN a note to Nature Mr. Spencer says:

The interesting article of Mr. J. H. Pillsbury, published in your last number, recalls to me a passage in my autobiography, which, though it is already in print, will not be issued until after my death. As bearing on the question Mr. Pillsbury raises, this passage may, perhaps with advantage, be published in advance. The plan suggested aims at no such scientific nicety of discrimination or naming as that he proposes, but is one which is applicable with the means at present in use. It is, as will be perceived, based on the old theory respecting the primary colors; but whatever qualification has to be made in this need not affect the method described. The passage is as follows:

"I mention it here chiefly for the purpose of introducing an accompanying thought respecting the nomenclature of colors. The carrying on of such a scheme would be facilitated by some mode of specifying varieties of tints with definiteness; and my notion was that this might be done by naming them in a manner analogous to that in which the points of the compass are named. The subdivisions coming in regular order when 'boxing the compass,' as it is called, run thus: North, north by east, north-north-east, north-east by north, north-east; north-east by east, east-north-east, east by north, east. Applying this method to colors, there would result a series standing thus: Red, red by blue, red-red-blue, red-blue by red, red-blue (purple); red-blue by blue, blue-red-blue, blue by red, blue. And in like manner would be distinguished the intermediate colors between blue and yellow and those between yellow and red. Twenty-four gradations of color in the whole circle would thus have names, as is shown by a diagram I have preserved.

"Where greater nicety was desirable, the sailor's method of specifying a half point might be utilized—as red-red-blue, half blue; signifying the intermediate tint between red-red-blue and blue-red by red. Of course, these names would be names of pure colors only—the primaries and their mixtures with one another; but the method might be expanded by the use of numbers to each: 1, 2, 3, signifying proportions of added neutral tint subduing the color, so as to produce gradations of impurity.

"Some such nomenclature would, I think, be of much service. At present, by shopmen and ladies, the names of colors are used in a chaotic manner—violet, for instance, being spoken of by them as purple, and other names being grossly misapplied. As matters stand there is really no mode of making known in words, with anything like exactness, a color required; and hence many impediments to transactions and many errors. In general life, too, people labor under an inability to convey true color conceptions of things they are describing. The system indicated would enable them to do this, were they, in the course of education, practiced in the distinguishing and naming of colors. If, by drawing, there should be discipline of the eye in matters of form, so there should be an accompanying discipline of the eye in matters of color."

Were some authoritative body to publish cards representing these various gradations of color, arranged as are the points of the compass, each division bearing its assigned name, as above given, such cards might serve as standards; and any one possessing them would be able to indicate, within narrow limits, to a shopkeeper or manufacturer the tint he or she wanted. Of course, to complete the method it would be needful that there should be a mode of indicating gradations of intensity, and if the numbers 1, 2, 3, were appended to indicate the degrees of impurity by mixture with neutral tint, a, b, c, might be used to signify the intensity or degree of dilution of the color.

Very possibly, or even probably, this idea has occurred to others, for it is a very obvious one.

HERBERT SPENCER.

The Mount, Westerham, July 30.

YELLOW COLORING MATTER.

By EDWARD H. RENNIE, M.A. (Sydney), D.Sc. (Lond.)

THE author describes a yellow coloring matter adhering to the seeds of two different species of Lomatia, a plant belonging to the order Proteaceæ. The coloring matter is easily extracted by hot water, and is regarded by the author as hydroxylapachol. Its barium derivative closely resembles the barium derivative of hydroxyhydrolapachol described by Hooker. When treated with sulphuric acid under certain conditions, it is converted into hydroxy-β-lapachone. Other derivatives are described in the paper, and also an isomeric hydroxylapachol.

DEODORIZING PETROLEUM.

AMYL acetate is added to the petroleum, in proportion varying with the quality of the latter, but 10 grammes of the acetate to 1 liter of petroleum is an average proportion. The product possesses an agreeable, slightly acid odor, and burns as well as the untreated petroleum does.—A. J. Tempére, Paris, France.

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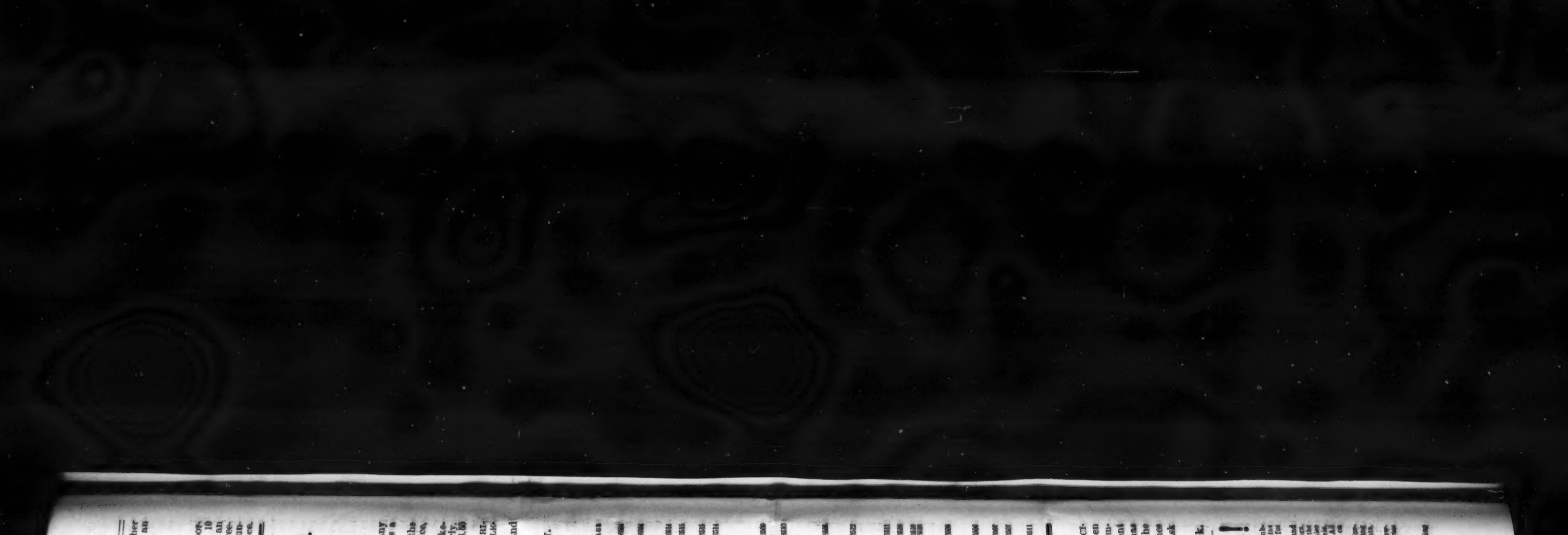
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